

Contact-Handled Transuranic Waste Characterization Based on Existing Records

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Prepared for the U.S. Department of Energy
Assistant Secretary for Defense Programs



Westinghouse
Hanford Company Richland, Washington

Hanford Operations and Engineering Contractor for the
U.S. Department of Energy under Contract DE-AC06-87RL10930

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Printed in the United States of America

DISCLM-1.CHP (1-91)

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Date Published
September 1991

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ABSTRACT

This report contains the results of characterizing the retrievably stored, contact-handled transuranic (CH-TRU) waste based on existing records. This report is the first comprehensive analysis of these records. A history of the methods used in storing the transuranic waste and in determining how the data was accumulated for entry into the Richland-Solid Waste Information Management System (R-SWIMS) is also described. Data from the R-SWIMS have been the primary source of information in characterizing the waste contents. Supporting documents and interviews with knowledgeable people provide the basis for documenting the history of storage practices. The storage conditions will be investigated further to ensure that a representative statistical sample is obtained for the second phase of this characterization program.

This document concludes the first of three phases of a characterization program described in WHC-EP-0223, Stored, Contact-Handled Transuranic Waste Characterization Plan (B. C. Anderson 1989). The program is being performed to provide the following:

- *Support the conceptual design of the Waste Receiving and Processing (WRAP) Facility*
- *Project the remaining storage life of containers*
- *Obtain information to support the design of retrieval equipment*
- *Provide future characterization program direction.*

The conclusions of this report are contained in Sections 4.11 "Summary and Conclusions," 5.2, "Summary of Conclusions: Burial Grounds and Trenches," and 6.0, "Container Integrity." The recommendations are contained in Section 3.0, "General Recommendations." The following results of the report are summarized:

- *The retrievably stored waste volume at the end of FY 1988 is 544,500 ft³. When it is retrieved and processed through WRAP it is projected that 4,400 ft³ will be research reactor fuel, 186,500 ft³ will be low level, and 353,600 ft³ will be TRU waste. It is also projected that the TRU waste will include 4,000 ft³ of remote-handled (RH) waste with the remainder (349,600 ft³) being CH.*

- *The remote-handled transuranic (RH-TRU) volume increased from 850 ft³ in alpha caissons to 4,850 ft³ in alpha caissons and trenches. This increase occurred because only caisson waste was considered previously in RH-TRU volume estimates and not RH-TRU waste intermingled with CH-TRU in trenches.*
- *A small portion of the stored waste (~4,400 ft³) to be retrieved is spent research reactor fuel identified in the R-SWIMS data base as TRU waste. Because of its origin and high level of radioactivity, it will not be managed as TRU waste after retrieval.*
- *Retrieval and handling of containers will require significant engineering design and equipment development effort to provide a methodology that will meet the following:*
 - *Adhere to as low as reasonably achievable (ALARA) principles*
 - *Minimize potential releases to the environment*
 - *Perform retrieval within reasonable cost and schedule considerations. (See Section 4.4 for additional information.) The retrieval of large boxes will be challenging, particularly because of the difficulty in handling.*
- *The identification of radionuclides and mixed waste constituents will have to be determined during treatment in WRAP since the existing records do not contain adequate information to meet current disposal requirements.*
- *It is projected that waste containers emplaced in the early years with direct soil cover will be breached. The retrieval of breached containers will require a portable, full-containment facility to prevent the spread of radioactive contamination.*
- *Actions should be taken to develop the examination and treatment processes for containers in the WRAP Facility in an efficient and cost-effective manner.*
- *Preliminary evaluations of container integrity indicate that the waste in areas 218-W 3A and 218-E 12B may be deteriorated to the point that a full-containment facility will be required to perform the retrieval operations.*

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CONTACT-HANDLED TRANSURANIC WASTE CHARACTERIZATION BASED ON EXISTING RECORDS

1.0 INTRODUCTION

The Hanford Site is one of 14 U.S. Department of Energy (DOE) sites located throughout the United States that generate and/or store radioactive transuranic (TRU) waste from national defense programs. This waste is buried in trenches of several different designs or configurations and stored in above-ground interim-storage areas.

In 1970, the U.S. Atomic Energy Commission (AEC) defined TRU waste as a separate waste category and declared that it must be stored in a form retrievable as contamination-free packages designed to last 20 yr, pending decisions on permanent disposal (Williams 1970). The Waste Isolation Pilot Plant (WIPP) in New Mexico is a research and development facility designed to demonstrate the safe and environmentally acceptable disposal of TRU waste from national defense programs.

The disposal at the WIPP of TRU waste stored at the Hanford Site since 1970 is required by DOE Order 5820.2A (DOE 1988a), and the Hanford Site *Defense Waste Final Environmental Impact Statement Record of Decision* (DOE 1988b). Disposal will consist of retrieving the waste and repackaging as necessary in the Waste Receiving and Processing (WRAP) Facility to certify for shipment to the WIPP. Retrieved waste found to be low-level waste (LLW) after examination in the WRAP Facility will be disposed of on the Hanford Site. Treatment of TRU waste containing hazardous waste components [TRU mixed waste (MW)] may be required in the WRAP Facility. The long-range master plan for the contact-handled transuranic (CH-TRU) waste (DOE 1987) specified that the Hanford Site waste will be shipped to the WIPP for disposal between 1999* and 2013.

A program for characterizing the Hanford-stored TRU waste before full-scale retrieval is described in WHC-EP-0223, *Stored, Contact-Handled Transuranic Waste Characterization Plan* (B. C. Anderson 1989). The goal of the program is to obtain the information needed to plan and design facilities and equipment required to retrieve, examine, treat, certify, and dispose of the retrievably stored, CH-TRU waste. The program is divided into three phases.

- Phase 1 was a study of TRU waste characteristics based on existing records as described herein.
- Phase 2 will be a sampling of a portion of the TRU waste, to consist of visual and nondestructive examination (NDE) of waste containers to determine integrity and retrieval and nondestructive assay (NDA) of containers to analyze content. Phase 2 will be carried out in fiscal years (FY) 1989 and 1990. A report is available that describes the sampling sites and containers to be retrieved and the basis for their selection (Anderson and Duncan 1989). The results of Phase 2 work will be published as they are completed.

*Shipments may be initiated earlier dependent on operational status of the WRAP Facility, planned for fiscal year 1996.

- Phase 3 will be a glovebox investigation of contents of retrieved containers; the necessity of performing Phase 3 depends on the results of Phase 2.

This report gives the results of the Phase 1 study. It provides an interpretation of the results contained on the Richland-Solid Waste Information Management System (R-SWIMS) along with the historical background of the system and the preliminary background information on areas for waste storage. The background information on the storage areas is presented in greater detail in WHC-EP-0226 (Anderson and Duncan 1989).

Inconsistencies may be present in many of the tables and are due to truncation and/or rounding affects.

2.0 PURPOSE AND SCOPE

2.1 PURPOSE

The purpose of this report is to provide qualitative information to support planning of the work-off of the solid waste, retrievably stored as CH-TRU waste at the Hanford Site since 1970. The information provided in this report also supports preparation of the CH-TRU waste sampling plan (Anderson and Duncan 1989). In addition, it provides a preliminary assessment of the length of time that containers can be stored safely.

The waste characterization information supplied in this report covers the time period of May 1970 through December 1988, which includes the time during which CH-TRU waste has been retrievably stored at the Hanford Site, and was obtained from the R-SWIMS. During this time period, several solid CH-TRU burial and storage requirements that perturb data assessments and storage-container correlation and comparison have occurred.

The history of the changes to the data base and storage configurations are presented in this report to aid in the understanding and interpretation of the data. The history also aids in identifying the areas that need to be explored either in the data base or in field inspections of the storage areas.

A result of correlating data is to identify the key areas that need further exploration. It also provides recommendations for the future management of solid-waste storage and burial operations. These recommendations are given in Section 3.0.

2.2 SCOPE

The scope of the information in this report is as follows:

- Preliminary baseline information on CH-TRU waste container content including weight distribution, radioactive material content, percent and type of waste material, hazardous and dangerous constituents in wastes, dose distribution, and generator source data
- The historical basis of the R-SWIMS data base and TRU waste storage configurations to permit proper interpretation of existing data that may affect retrieval and treatment
- Preliminary information on the adequacy of 20-yr retrievable storage containers and lifetime data, based on supporting documents. [This information will aid in the preparation of the Resource Conservation and Recovery Act (RCRA) Part B permit application for the low-level burial grounds]
- Qualitative assessment of the existing TRU waste records and recommendations on action required in subsequent phases of this characterization program.

Information obtained in subsequent phases of this solid CH-TRU waste characterization program will be used to update this information.

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3.0 GENERAL RECOMMENDATIONS

The following recommendations are based on the conclusions presented in Sections 4.11, 5.2, and 6.4.

1. Actions should be accelerated to determine the condition of containers in the 218-W 3A and 218-E 12B disposal and storage areas because of their suspect condition. The basis for this recommendation is contained in Sections 5.0 and 6.0. The key information to be ascertained is whether or not the waste containers were covered with plywood and a nylon tarp before covering with soil. The space between the TRU waste containers and buried LLW containers also needs to be determined. The condition of the containers in the 218-W 4B and 218-W 4C areas should be evaluated, as planned, in the retrievably stored waste characterization plan (B. C. Anderson 1989).

The retrieval of breached containers will require a portable full-containment facility to prevent the spread of radioactive contamination. Personnel performing the retrieval operations will be required to wear protective clothing and respiratory protection. Retrieval under these conditions will be a very slow process.

2. Emphasis should be placed on developing the NDE/NDA equipment required to perform the receipt inspection in the WRAP Facility. Identifying and quantifying the radionuclides currently identified as mixed fission product (MFP) may require development of equipment requiring a long lead time to place in operation. The NDE of containers at receipt in the WRAP Facility will reduce the hazards that may be incurred during treatment.
3. The scope of the WRAP Facility needs to be evaluated to determine if it should include the treatment of remote-handled (RH) wastes (due to the significant volume of RH wastes intermingled in the same storage areas as retrievable CH-TRU waste). The increase in RH waste is projected to be increased from 847 to 4,850 ft³. This item is discussed in detail in Section 4.6.
4. Priority should be given to development of the handling equipment required to retrieve and transport the variety of large heavy boxes and other odd-size containers to the WRAP Facility. The design of the WRAP size-reduction facility and receipt-inspection areas will have to be completed in parallel with this effort.
5. The methodology to treat the waste in 55-gal drums should be a lower priority at this time. This recommendation is made because the MW constituents cannot be identified by the existing records. The requirements for treatment of potential mixed waste in storage since 1970 can be specified on receipt of guidance from DOE and information on the impacts of WIPP licensing to receive mixed waste.

6. The integrated data base submittal in March 1989 should be based on the information in Section 4.0 of this report. This data base would update the stored waste information to reflect what TRU waste will be shipped to the WIPP. The CH-TRU volume will decrease slightly and the RH-TRU waste will increase significantly. This item is discussed in detail in Sections 4.6 and 4.9.
7. The R-SWIMS data base has been effective in identifying the characteristics of TRU waste. The evolving regulatory requirements will require that it be expanded and accessed routinely to develop similar reports other than TRU waste. Consequently, it is recommended that the R-SWIMS data base be expanded to ensure the additional information on future waste receipts can be included in the data base.
8. The R-SWIMS data base information should be available to retrieval personnel to provide ready access to information. This access will aid in identifying and minimizing hazards that may be encountered during retrieval.
9. Actions should be taken to ensure that the waste generators are identifying and quantifying the radionuclides in the waste containers shipped for storage or burial. Currently 67% of the activity is identified in the R-SWIMS as MFP. See Sections 4.8 and 4.11 for additional information.
10. The retrieval and treatment of classified waste should be performed with the concurrence of the facility that originally classified the waste to provide necessary background information. Also, the treatment of this waste could require security involvement in WRAP operations.

4.0 RETRIEVABLY STORED, CONTACT-HANDLED TRANSURANIC WASTE BASELINE INFORMATION

Transuranic-bearing wastes have been packaged in sealed containers and segregated from LLW in retrievable storage trenches since May 1, 1970. Before then, the TRU wastes were commingled and buried with the LLW. About 544,500 ft³ of wastes designated as TRU waste have been retrievably stored on the 200 Area plateau from May 1, 1970, to December 31, 1988. These wastes consist of dry waste (e.g., soiled clothing, laboratory supplies, tools, etc., packed in cardboard, wood, or metal containers) and industrial waste [primarily items of failed process equipment, packaged in plastic shrouds, wood, fiber glass-reinforced polyester (FRP), metal, or concrete boxes]. Solid CH-TRU wastes are retrievably stored in 25 trenches and four facilities on the 200 Area plateau.

The creation in 1970 of the TRU waste category designated 10 nCi/g as the lower limit for TRU radionuclide content, and waste with TRU content greater than that limit was stored as TRU waste in the Hanford Site burial grounds. In 1982, the limit was revised upward to the present value of 100 nCi/g. The equipment required to assay at the 100 nCi/g limit was installed in the Transuranic Storage and Assay Facility (TRUSAF) in 1985. Thus a portion of the waste stored between 1970 and 1985 no longer is TRU waste. This report provides a detailed projection of the breakdown of stored waste into TRU and low-level waste (i.e., waste which will be designated LLW when assayed in WRAP).

Current plans are to retrieve the wastes, retrievably stored as TRU waste after 1970, for future processing and certification in the WRAP Facility and shipment to the WIPP geologic repository for TRU waste or for burial on the Hanford Site as LLW. The alternatives for treating pre-1970 wastes and equipment stored in the plutonium-uranium extraction (PUREX) tunnel are being evaluated and will not be addressed in this report. Based on the information supplied in this report and the subsequent CH-TRU sampling plan (Anderson and Duncan 1989), some retrievably stored, CH-TRU wastes may be redesignated and treated as LLW.

Data contained in the R-SWIMS data base are summarized in this report, and a summary of the information is included in Sections 4.1 through 4.10. The conclusions to these sections are provided in Section 4.11. The following historical information identifies or clarifies the limitations of the available data.

Between 1970 and 1982, waste characterization information on Solid Waste Burial Records (Figure 4-1 shows an early example*) was tracked only by shipment, not by individual container. Consequently, if the shipment contained more than one container, the contents and values were divided equally among all similar waste containers in the shipment.

In 1982, individual container tracking was made available by the use of the Solid Waste Burial Record-Transuranic (Figure 4-2). Subsequent changes have improved the information contained in these records.

*Due to the amount of tabular and graphic data contained in this report, all tables and figures will be located at the end of the respective Sections (4.0, 5.0, etc.).

Data input and subsequent data base expansion to provide additional information has been changed over the years because of imposed changes to container, waste, and storage requirements. These changes have perturbed the consistency of information available in the R-SWIMS data base. Also, these changes have improved the quantity and quality of information available for characterization but likewise have resulted in informational discontinuities within the data base. The informational discontinuities exist in the older waste records. Forthcoming regulations will undoubtedly expand the requirements and require additional data in the R-SWIMS data base, resulting in additional informational discontinuities. It is virtually impossible to obtain data for a waste characteristic that was not specifically recorded on the original storage or disposal records. Thus, discontinuities are inevitable whenever data requirements change.

4.1 RICHLAND-SOLID WASTE INFORMATION MANAGEMENT SYSTEM DATA BASE AND HISTORICAL BACKGROUND

The R-SWIMS data base at the Hanford Site resides on the NAS6620 mainframe computer using hierarchical NOMAD 2 Data Base Management System software. The purpose of the data base is to track all radioactive solid waste that has been buried or stored in the 200 East Area and 200 West Area burial grounds from 1944 to the present (McCann 1987).

The hierarchical NOMAD 2 Data Base Management System schematic is diagrammed in Figure 4-3. The data are entered into parent and children files. Relating information in two different children files (e.g., container and toxicity information) requires that the programmer identify data in the parent (shipment) file, which can be used to patch the children file information together (McCann 1987). This process requires programmers that are very knowledgeable with the R-SWIMS data base and NOMAD 2. Improper patching of data will result in erroneous information.

The data in the data base are based on information entered on the Solid Waste Storage Record (SWSR) and input into the R-SWIMS. The information on the SWSR, other than container size and weight, was based on a per-shipment basis (from 1970 through 1981) and since 1982 has been on a per-container basis. Information in the SWSRs has changed over the years as requirements, regulations, and the increased need for more complete characterization arose. Some of the major changes imposed by changing regulations and limits are listed (Table 4-1).

Historically, several other changes requiring additional information on TRU wastes have altered the scope of the R-SWIMS data base. In 1972, it was decided that the beta-gamma components of the waste should be decayed so that the input values and the decayed values could be tracked. This decay program assumed that all of the radionuclides were MFPs and that the radionuclide mix was one year after discharge from the reactor.

From this information, one could take a radiation reading and convert this reading to a total curie value. The computer would then divide the curie value into its various radionuclide components based on general source data and the facilities operational mission. This method is still being used for many of the facilities shipping waste for disposal and storage at the Hanford Site.

Spent fuels from research reactors were first received in the mid-1970s and are still being received at burial ground facilities. This material, low in volume and high in weight, is tracked as if it were TRU waste, and the data in the quarterly reports assume this material is TRU waste. Consequently, the data are included as part of the TRU waste in this report. When it is processed through the WRAP Facility, it may be declared high-level because of its origin and high

level of radioactivity. The Integrated Data Base (IDB) submittal includes this in the miscellaneous research reactor fuel category. This research reactor fuel will be retrieved with the stored TRU waste; treatment or restorage of the spent fuel has not been addressed at this time.

In 1976, the Solid Waste Information Management System (SWIMS) Program at the Idaho National Engineering Laboratory (INEL) requested that more data be tracked and reported to the SWIMS. The two main changes were for weight values and for waste categorization. The weight values were estimated for the purposes of record keeping; however, as more solid-waste generators kept better track of their weights the values were no longer estimated. The waste categories were estimated until 1986 when the data were tracked on the computer data base.

In 1980, data from group shipment records were placed in the computer data base. In 1986, however, a data reentry program was undertaken, and data from each individual record were input to the computer. During this reentry, information was gleaned from the SWSR to provide the current data base. This data reentry program was completed in 1988 and covers the time frame from 1968, when records were first kept, to current waste receipts. Before this time frame, most of the data in the data base was based on annual estimates.

In 1982, requirements to track individual TRU containers were enacted, replacing the per-shipment accountability method. In 1985, the Solid Waste Burial Record-Transuranic (Figure 4-2) was changed to the Solid Waste Storage Record-Transuranic (Figure 4-4). This change required more information on the hazardous material constituents and required defining the contents waste form. In 1988, the SWSR (Figure 4-5), was modified again to require additional information required by DOE Order 5820.2A (DOE 1988a).

November 1984 marked the first time the NOMAD 2 system was used for record keeping. As all existing TRU records have now been input to the data base, the method of accessing the data is in place to provide information on the following:

- Waste form information (glass, concrete, plastic, cloth, rubber, etc.)
- Hazardous/corrosive constituents and quantity (post-1985 waste only)
- Radioactive material content (radionuclide identification and quantity, radiation level, etc.)
- Storage site location and date
- Generator or source of waste
- Container data (i.e., drums, steel or wood boxes, container size, volume, gross weight, etc.).

4.1.1 Data Base Assumptions

To understand the NOMAD 2 data base, several assumptions need to be known. They are listed as follows.

- Except for 105-N (N Reactor) and B Plant waste, all beta-gamma waste is assumed to be MFPs if specific radionuclides are not provided in the burial or storage record. This calculation is based on the fuel that is processed at the PUREX Facility. For 105-N, the mix is

assumed to also contain mixed activation products, which are entered in the data base as MFPs. All estimations that are not directly given by the waste generator are calculated based on these ratios. B Plant has processed ^{90}Sr and ^{137}Cs , and as a result, these radionuclides are assumed to be the major constituents of the waste.

- The decay calculation portion of the NOMAD 2 program is only for the beta-gamma emitters, as described above, that are below lead in the periodic chart. Transuranics, and a few other radionuclides such as uranium and thorium, are not accounted for do to their long half-lives and negligible amount of decay.
- The decay calculations are based on the dates on the burial or storage records.
- Weights for most of the containers received before 1977 were estimated as part of the data upgrade. After this date, generators were required to provide this information. Weight calculations were established for pre-1977 waste at 28 lb per Hanford Site standard cardboard box, small boxes at 12 lb per cardboard box, lard cans at 50 lb, and TRU drums at 150 lb, or as specified on record; LLW drums and all other waste types were at 28 lb/ft³. Some exceptions were containers filled with dirt or concrete for which 90 or 120 lb/ft³ were used.
- The data for LLW and the pre-1982 TRU waste are on a per-shipment basis. If the shipment contains more than one container, only total values (not individual container values) are available. There is no container or shipment data available on waste generated before 1968. After TRU segregation began (May 1970) and until 1982, data for TRU content, for most individual containers, are based on a per-shipment basis. Consequently, if more than one container is present, only total values (not individual container values) are available. The contents are divided equally among all of the waste containers in the shipment, introducing an averaging effect on the data.
- Individual data for TRU waste containers, other than TRU content, was not implemented fully until 1984.
- Hazardous constituent data, when documented on the burial records, were entered into the data base as part of the reentry program. However, it was not until 1986 that the hazardous constituents were required to be listed by the generator on the TRU storage records. Consequently, the data on hazardous constituents are very limited.
- Since 1986, the computer has tracked the certified TRU waste after it has been nondestructively examined in TRUSAF. Data obtained in TRUSAF has not been entered into the data base.
- The data base has the capability to track liquid organic waste; however, this capability is not yet complete, and new codes must be installed to indicate the new types.
- Waste types, such as paper, cloth, equipment, etc., are entered into the data base. Before 1978, this type of data was limited because much of the waste was designated as miscellaneous process waste.
- Data from Nuclear Material Transaction Reports, DOE/Nuclear Regulatory Commission (NRC) Form 741, were added to the data base during entry of information in the R-SWIMS. Some of the radionuclide values increased significantly because this type of data was not accounted for previously in the data base. Increases occurred in plutonium, enriched uranium, natural uranium, depleted uranium, and thorium.

4.2 SUMMARY OF SOURCES (WASTE GENERATORS)

Retrievably stored, CH-TRU waste has been received from 55 generating areas, buildings, and offsite facilities. The annual accumulation of this waste at the Hanford Site is presented in Table 4-2. The major sources (greater than 1% of waste volume) are listed in Table 4-3. The Plutonium Finishing Plant (PFP) is the major source of CH-TRU solid waste, by volume, at 53.6%. The second through fourth place sources are 231-Z building, PUREX facilities, and the Westinghouse Advanced Reactor Division, which provided 8.2%, 7.2%, and 5.7%, respectively. All other sources each provided less than 5% of the total stored-waste volume.

Appendix A provides a complete listing of the sources of waste. It also includes the annual volume; annual number of drums, boxes, and other containers; and the percentage of the total waste volume provided by each source. Appendix B identifies the containers in the other category by source and year.

Table 4-4 provides a summary (by container type) of radiation level, grams of TRU nuclides, and containers with MW. Since MW data were not required before 1986, the MW values are underestimated. (This item is discussed further in Section 4.10.)

The characterization of CH-TRU waste has concentrated on container categories that represent significant portions of the waste. These categories are 55-gal drums, metal boxes, FRP boxes, concrete boxes, and plywood boxes. All of the remaining container types were placed in the "Other" category.

The "Other" category containers will require special handling in the WRAP Facility because of the unique shape, size, and containment. For example, these "Other" containers will have to be examined using the box NDE and NDA equipment because of varied shape and size. The impacts of container size and shape are discussed further in Section 4.4.

4.3 SUMMARY OF WASTE-FORM DATA

The first entry of waste-form data occurred in January 1978 as miscellaneous ("Misc."). During the subsequent years, the quality of the entries improved significantly. Table 4-5 summarizes the information on the waste received since the 1978 time period.

Very few containers contain 100% of any one waste form. Combustible versus noncombustible segregation was required for the 1972 to 1978 period and, as such, represents the only segregation requirement imposed on waste generation.

Approximately two-thirds of the TRU waste in drums is combustible material (paper, plastic, rubber, etc.), and the remaining one-third is noncombustible (metal and glass). The TRU waste in FRP and metal boxes is predominantly noncombustible (75%).

Accumulation of waste-form data requires significant computer time and subsequent hand calculation to present the percentages shown in Table 4-5. Consequently, variations with respect to age and waste generator were not pursued. Additional information will be obtained, if required, to support the retrieval and selection of WRAP treatment processes.

4.4 SUMMARY OF CONTAINER TYPE AND SIZE DATA

As described briefly in Section 4.2, the CH-TRU waste has been packaged in a wide variety of containers. Table 4-6 provides a summary of the container by type of construction material, the quantity of each, and total volume. Appendix D contains a listing of the size variation by type of construction material, including quantity of each size. Standardization of container sizes has not been practiced at the Hanford Site.

The retrieval and in situ inspection of the variety of shapes and sizes in the box and other categories will require developing a number of container-handling methodologies, such as: ensuring that containment is not lost during preliminary container inspection, container removal from the trench, transport to the WRAP Facility, and receiving inspection in the WRAP Facility. The methodology development is planned for Phase 2 of the characterization program (B. C. Anderson 1989).

The condition of stored TRU waste containers (from Hanford and other DOE sites) is discussed in Section 6.0. This discussion provides additional information useful for retrieval equipment design and retrieval operations. Phase 2 of the characterization program will determine the actual condition of containers in retrievable storage.

Appendix C contains typical drawings of containers used to store the CH-TRU waste. Actions are underway to develop a file with all available drawings of stored TRU waste containers. This file would then be available to personnel designing retrieval equipment, WRAP handling equipment, and WRAP treatment and examination facilities.

4.5 SUMMARY OF CONTAINER WEIGHT-DISTRIBUTION DATA

A summary of the drum-weight distribution is provided in Table 4-7. Inputting the unknown weight of drums as 150 lb is reflected by the nonvariability in the 1970 to 1981 time span. The overall drum average weight was calculated to be 174 lb. There are at least 610 drums that contain lead and are above 600 lb in weight. The maximum weight is 2,818 lb. During processing in the WRAP Facility, these wastes may be declared RH waste, as the weight may be lead shielding for highly radioactive contents. Tables 4-8, 4-9, and 4-10 identify the variability (all years) with respect to waste generators. Most of the heavier drums were received from offsite generators, and the lead apparently was used to meet transportation radiation limits.

A summary of the metal box weight distribution is shown in Table 4-11. The maximum weight of 35,000 lb, or 17 1/2 tons, will provide a challenge during retrieval and size reduction in the WRAP Facility.

Table 4-12 provides similar information for FRP boxes. The maximum weight of 83,000 lb, or 41 1/2 tons, will also be a challenge. It should be noted that 60 of the 202 FRP containers are greater than 10 tons.

Tables 4-13 and 4-14 show that weight data on plywood and concrete containers were received during the period when container weights were based on calculation. The actual weights could be significantly different. Information obtained verbally indicated that the plywood containers were not built for storage but rather for the transport of the waste from 234-5Z Plant to the low-level burial ground. A few boxes were removed using slings. Most were loaded and unloaded using the drag-on/drag-off methodology. This methodology should be considered for retrieval if the container deterioration is not too severe.

The retrieval and handling of large boxes will require significant engineering design and equipment development efforts to provide a methodology that will (1) provide the means of retrieval that adheres to as low as reasonably achievable (ALARA) principles, (2) minimize potential releases to the atmosphere, and (3) perform retrieval within reasonable cost and schedule considerations.

4.6 SUMMARY OF DOSE-RATE DATA

Table 4-15 provides a summary of the dose-rate data by container type. It should be noted that a small percentage (1%), but significant number of containers (120) in the pre-1977 era exceed the 200 mrem/h criteria for CH waste. Treatment in the WRAP Facility will result in reclassifying this waste as RH. There are 92 of these 120 containers that are 55-gal drums constituting 900 ft³. It is anticipated that the majority of the concrete boxes (7,024 ft³) will also be reclassified as RH or research reactor fuel waste when they are reduced for transport to the WIPP. These radiation levels will impose restrictions on the methods of retrieval to minimize exposure to personnel. It should be noted that the boxed waste will require size reduction in the WRAP Facility before it can be transported. This reduction will result in increasing the scope of the WRAP Facility to size, reduce, and treat waste with high radiation levels.

Table 4-16 provides information to identify the variability of data with respect to source. The containers with the highest radiation level are from onsite waste generators. The information in this table comprises data from 1970 through 1988.

Comparing the information in Tables 4-15 and 4-16 indicates that the information is more complete in the later years (noted by the reduction in no value entries). The radiation level entered in the R-SWIMS for the pre-1982 TRU waste was on a per shipment basis, and only the highest radiation level for the container type was recorded. The radiation levels shown for this period consequently should show a higher average than the current individual container records; however, the data show the opposite trend. An explanation for this would be that the early waste contained lower activity material.

4.7 SUMMARY OF TRANSURANIC GRAM PER CONTAINER DISTRIBUTION

Tables 4-17, 4-18, 4-19, 4-20, 4-21, and 4-21A provide the TRU gram distribution with respect to age of drums, metal boxes, FRP boxes, concrete boxes, and plywood boxes.

The gram loading in 46 drums exceeds the 200-g limit required for transport and certification for shipment to the WIPP. Nine drums are greater than 350 g. The drums will require special controls during handling and treatment in the WRAP Facility to ensure compliance with criticality specifications.

The gram loading in a few of the boxes also exceeds the 350-g limit stipulated by the WIPP for boxes. Since the boxes will be size reduced and packaged in more than one container in the WRAP Facility, it will probably result in gram loadings that easily meet the WIPP criteria.

4.8 SUMMARY OF ISOTOPIC DISTRIBUTION DATA

Table 4-22 provides gram and curie values for each isotope currently in all of the CH-TRU storage facilities. The columns on the right identify the activity and weight percent. The MFPs provide 67%

of the activity in the waste. The uranium radionuclides provide 95% of the radionuclide weight. The TRU radionuclides provide 23% of the activity and 2% of radionuclide weight.

The high MFP percentage will require development of assay equipment for the WRAP Facility to identify the isotopic distribution associated with this category. The isotopic distribution is needed for transportation, and it recently has been identified as a requirement for receipt at the WIPP.

Table 4-23 provides data on 12 drums with high ^{238}Pu loading. These drums will require special handling and packaging to meet the transportation (thermal) requirements proposed for the Transuranic Package Transporter 2 (TRUPACT-2).

Table 4-24 identifies the variability of isotopic data with respect to age. The "Grams to curies quantity" column is the product of grams and specific activity; it is curie equivalent of the gram column. Conversion from curies to grams (or vice versa) can be performed by using the "Specific activity" listed in Table 4-22. The R-SWIMS maintains the information in either the gram quantity or the curie quantity but not both. The plutonium listing is predominantly ^{239}Pu ; however, it does include ^{240}Pu , ^{241}Pu , and ^{242}Pu .

Table 4-25 identifies the variability of the isotopic distribution with respect to source. This variability also will present a challenge in performing the assay of this waste to certify it for shipment to the WIPP. The passive-active assay system, developed by Los Alamos National Laboratory (LANL), requires that the basic mixture of isotopes be known. Since this mix ratio is not known for Hanford Site CH-TRU stored wastes, the percentage of each isotope will have to be determined by other methodologies.

A change in the distribution should be with respect to source, not container type. Consequently, the determination of the isotopic distribution in different types of boxes and drums was not performed as part of this study.

4.9 SUMMARY OF LOW-LEVEL WASTE -TRANSURANIC WASTE DISTRIBUTION

Table 4-26 provides the TRU gram distribution with respect to age of waste in drums. The LLW to TRU waste split was calculated to be 0.08 g per drum. The average weight of contents was judged conservatively to be 140 lb (or 190 lb average gross weight) based on information in Section 4.5. The specific activity for TRU alpha radionuclides is 0.08 Ci/g.

Based on the above values, the percentage of drums that will be declared LLW in the WRAP Facility is 47%. The variation with respect to age is 58% for waste packaged in the 1970 to 1977 period, 47% for the 1978 to 1981 period, 34% for the 1982 to 1985 period, and 9% for the 1986 to 1987 period. Initially, a four-year increment was selected to identify changes in the waste characteristics. During the data review, the first two increments were combined because of the limited data in this 1970 to 1977 time period.

Similar calculations were made for the boxed waste, identified in Tables 4-27, 4-28, 4-29, and 4-30 for metal, FRP, concrete, and plywood boxes, respectively. The waste content was assumed to be half of the gross weight. Alpha curie values (calculated by a NOMAD 2 routine) were used rather than gram loadings. The containers that are projected to be declared LLW in the WRAP Facility are denoted by an asterisk in the right side of the data.

Based on the above, it is projected that 40 of the 329 (12%) metal containers will be declared LLW. These containers represent 8,057 ft³ (12%) of the metal box volume. Similarly, 62 of the 202 FRP boxes are projected to be LLW. This amount is 13% of the FRP box volume. Thirty-five of 58 (60%) concrete boxes would be declared LLW, constituting 22% of the volume. It was assumed that the waste weight would be less in the concrete box; consequently, one-third of the package weight was used in this calculation.

All but three of the plywood boxes or 85% of the volume in Table 4-30 would be projected to be LLW. The data in Table 4-30A indicates that 20% of the waste in other types of containers will be declared LLW. The net result is that at least 31.6% of all waste stored in trenches at the Hanford Site is projected to be redesignated as LLW when processed through the WRAP Facility.

Since the size reduction of boxes may provide additional segregation and packaging of higher activity materials, the volume of waste that will be declared LLW probably will be higher than the above projections. The net result would be that additional waste in metal and FRP boxes could be declared LLW. The amount of reduction may be significant, although precise estimates cannot be made at this time. The means of accomplishing this segregation should be part of the requirement for the size-reduction facility. In addition, averaging the inventory data based on shipment information (1970 to 1982) results in decreasing the population near the lower limit. Consequently LLW volume is considered low.

Correspondence between DOE-RL and Rockwell stated that PURM were to be stored as TRU waste (Albaugh 1980), however, the recovery of these materials should be evaluated as improved processes or possible economic value may make it feasible for recovery in the future. The work-off of TRU waste is scheduled to occur between 1999 and 2013. The projected economic value for PURM is needed to determine if it would be cost effective to recover these radionuclides in the WRAP Facility.

The economic value of the stored-waste radionuclides may be in the \$200 to \$800 million range. These values are speculative and assume that the radionuclides could be recovered fully, which, with current technology, is not practical. A 10% recovery, however, would represent a significant cost savings.

4.10 SUMMARY OF MIXED WASTE DATA

The MW information contained on the R-SWIMS is underestimated since data have only been required since 1986. However, information has been included if the SWSR identified a hazardous material constituent. Table 4-31 shows that only 2.15% of the containers contain MW, and 2.09% of the MW is contained in 786 drums.

The percentage data in table 4-31 are considered to be low because the methods of identifying MW, as required by RCRA, are being developed at the generating facilities. Additional information was requested from waste generators using WHC-EP-0223, Appendix C (B. C. Anderson 1989), to permit evaluating how the MW issue should be handled in the WRAP Facility. Responses from waste generators provided minimal information with respect to MW. The treatment in the WRAP Facility, consequently, will have to include the methodology of identifying MW constituents.

Tables 4-32 through 4-36 identify the MW constituents with respect to container age. The percentage of MW containers decreases with age, as expected, since the requirements for reporting MW data were not in place before 1986. Consequently the 1986 to 1988 time period should be indicative of the MW volume. During this period 12.6% of the drums contained MW.

The only way to identify the MW constituents is to sample the containers. The time to sample this waste (i.e., before or after WRAP treatment) cannot be projected until the impacts of the WIPP RCRA licensing are known.

The toluene, xylene, and solvents in drums may present a hazard during retrieval. These materials have a low vapor pressure and the void volume in the container could contain flammable or explosive gas mixtures. Hydrogen generation because of radiolysis, chemical decomposition, and bacteriological actions of the waste may also present similar hazards at retrieval. Sealed metal containers will have to be vented during retrieval operations to mitigate the risks associated with subsequent handling operations.

4.11 SUMMARY AND CONCLUSIONS

Tables 4-37 through 4-41A provide a composite of much of the data included in previous tables by major container type. These tables were prepared to identify parameter interrelationships as discussed in previous sections.

The following is a listing of the conclusions from these tables and from previous sections.

- Waste Generator Overview (from Section 4.2). The containers listed in the "Other" category will require special handling in the WRAP Facility because of their unique shape, size, and methods of containment. Most will have to be examined using the NDE and NDA equipment designed for boxes.
- Waste-Form Data Overview (from Section 4.3). The waste contents are an unsegregated mixture of waste forms. Very few contain 100% of any one waste type, although all of the major constituents (metal, absorbed liquids, poly, paper, etc.) appear to be present.

The following summarizes the combustible and noncombustible percentages in CH-TRU waste containers.

Container type	Percentage	
	Combustible	Noncombustible
55-gal drums	65	35
Metal boxes	24	76
FRP boxes	34	66
Concrete	69	31
Plywood	87	13
Other	31	69

- Container Type and Size Overview (from Section 4.4). The large variety of box size, weight, and material will require development of the following:

- Retrieval methodology for each container design
- Handling equipment for groups of containers
- Design for the largest container. At a minimum, receipt inspection and volume reduction will have to be designed for the largest container. It is doubtful that one set of NDE and NDA equipment can effectively inspect the large range of container size, shape, and weight. The size, weight, and shape variations may require that the recorded value be used until it is repackaged in the WRAP Facility.

The retrieval and handling of large boxes will require a significant engineering design and development effort to provide a methodology that will (1) provide a means of retrieval adhering to ALARA principles, (2) minimize potential releases to the atmosphere, and (3) perform retrieval within reasonable cost and schedule considerations.

- Container Weight Distribution Overview (from Section 4.5). The gross weight of containers has a large variation. Although minimum weights were not requested specifically from the R-SWIMS, the following is provided to reflect the variance.

Container type	Minimum weight (lb)	Average weight (lb)	Maximum weight (lb)
55-gal drum	<100	174	2,818
Metal box	<5,000	4,987	35,000
FRP box	<5,000	15,490	83,000
Concrete box	<5,000	12,170	45,500
Plywood box	<5,000	9,086	55,440

Actual container weights were not recorded before 1977; however, the weights subsequently were calculated based on general assumptions stated on page 4-4 and not on specific contents.

- Dose Rate Overview (from Section 4.6). The contact radiation level of the container is as follows:

The drum volume (918 ft³) does not include 229 shielded drums (1,695 ft³) identified in Section 4.5 that may also be classified as RH-TRU waste after treatment in the WRAP Facility. An additional 6,293 ft³ (7,024 ft³ total) of waste in concrete boxes may be classified also as RH or research reactor fuel wastes when it is processed in the WRAP Facility. Conversely, as discussed in Section 4.9, the 1,083 ft³ of the waste boxes and 431 ft³ of the drummed waste may be classified as low level during processing in the WRAP Facility. The RH-TRU waste volume, consequently, could increase from 850 ft³ (in alpha caissons) to a value between 2,350 and 11,850 ft³. The 3,860 ft³ value rounded to 4,000 ft³, or 4,850 ft³ total, is considered to be the most realistic.

Container type	% No. record value	% Less than 5 mrem	Average mrem/h	Maximum mrem/h	Volume above 200 mrem/h (ft ³)
55-gal drum	85	90	11.6	30,000	918
Metal box	16	85	25	2,625	462
FRP box	28	73	98	4,500	784
Concrete box	2	16	405	2,625	731
Plywood box	15	3	809	3,000	800
Other*	7	60	Not requested	10,000	85
Total				30,000	3,860

*Excludes casks.

- Transuranic Grams per Container Overview (from Section 4.7). The gram loading in waste containers is as follows:

Container type	% Less than 0.1 g	Average grams per container	No. above the WIPP limit
55-gal drum	47	11	46
Metal box	20	52	7
FRP box	25	44	6
Concrete box	36	82	3
Plywood box	5	1	0
Others	57	81	28

Drums above the WIPP limit of 200 g per drum will have to be repackaged. Boxes above the WIPP limit of 350 g will be distributed during the size reduction of the boxed waste.

- Isotopic Distribution Overview (from Section 4.8). Sixty-seven percent of the activity in the retrievably stored waste is identified as MFP. Ninety-five percent of the radionuclide weight is associated with uranium. The TRU radionuclides provide 23% of the activity and 2% of the radionuclide weight.

During the processing in the WRAP Facility, the MFP isotopic identity will be determined to meet transportation and disposal criteria (TRU waste and LLW). Assay equipment will be obtained to perform this function in addition to the LLW and TRU waste segregation and measurements for criticality control.

- Low-Level Waste/Transuranic Waste Distribution Overview (from Section 4.9). The quantity of waste that is projected to be LLW when processed in the WRAP Facility is as follows:

Container type	Minimum		Recommended for planning	
	% of LLW by volume	% of TRU waste by volume	% of LLW by volume	% of TRU waste by volume
55-gal drum	47	53	50	50
Metal box	12	88	15	85
FRP box	13	87	15	85
Concrete	22	78	20	80
Plywood	85	15	85	15
Other	20	80	20	80
All	32	68	35	65

The LLW percentage will increase if the high-activity material can be segregated and packaged separately as part of the size-reduction activity in the WRAP Facility. The highest percentage of this LLW will be from waste stored during 1970 and 1981. The recommended values are considered to be conservative estimates of the TRU waste volume.

The recovery of PURM in the WRAP Facility should be evaluated. There will be approximately 500 kg of these radionuclides processed through the WRAP Facility. This processing may increase the complexity of WRAP treatment, however, recovery may be cost effective.

- **Mixed Waste Overview (from Section 4.10).** The information in the current records is not adequate to meet RCRA requirements. Because of difficulties associated with obtaining the additional information from historical records, it is recommended that additional sampling be included as part of WRAP to meet the RCRA requirements, as found in the Code of Federal Regulations, 40 CFR 261, Appendix H. Sampling analysis costs currently are projected at \$2,000 per sample if constituents are unknown. The compliance with RCRA requirements may be a significant WRAP operational cost item. The mitigation of hazards because of flammable or explosive gas mixtures will require container venting during retrieval of the waste.

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Figure 4-1. Solid Waste Burial Record (1968 to 1982). (Sheet 1 of 2)

SOLID WASTE BURIAL RECORD 300 AREA PLATEAU DISPOSAL SITE OPERATED FOR RL - AEC BY ATLANTIC RICHFIELD HANFORD COMPANY						
<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> DISPOSAL SITE <small>THIS SECTION OF FORM TO BE COMPLETED BY ARMED REPRESENTATIVE AT DISPOSAL SITE</small> </div> <div style="width: 45%;"> SHIPPER </div> </div>						
AREA	BURIAL CARRIER NO.	TRENCH NO.	SHIPMENT NO.			
CARCASS NO.	COORDINATES N _____ E _____		COMPANY			
REMARKS			BUILDING: _____ AREA: _____			
			ADDRESS (OFF SITE)			
DATE		TIME		DATE		
SIGNATURE			SIGNATURE			
PHYSICAL DESCRIPTION MATERIAL CONTENTS (NOTE ANY SPECIAL CONDITIONS) E.G., BULKY, ACID, EXPOSURE TO LUBRICANT, PAPER WASTE, VIBRATION, ETC.						
CONTAINER	BOX	NO.	LENGTH	WIDTH	HEIGHT	<input type="checkbox"/> HANFORD STANDARD CARDBOARD
	DRUM	NO. AND SIZE				
	OTHER	NO. AND SIZE				
	TOTAL VOLUME (FT ³)					
ACTIVITY DESCRIPTION GENERAL ACTIVITY DESCRIPTION (E.G., LONG-TERM MONITORING SUCH AS PM, CO, SF, CALIBRATED PIONEER PRODUCTS; ACTIVATION PRODUCTS)						
PLUTONIUM		URANIUM		ACTIVITY (IF PM OR U, ONLY UNITS IN GRAMS REQUIRED)		
DOSE RATE		DOSE RATE		CURIES		
		R/M		<input type="checkbox"/> SURFACE <input type="checkbox"/> INCHES <input type="checkbox"/> FEET		
DISTRIBUTION:		BY ORIGINATOR			BY ARMED - SIGN AND FORWARD TO:	
WHITE - } ARMED YELLOW - } PINK - DETAIL GOLDENROD - (HWT) WBS, SEE SLDS. GOLDENROD - (HWT) WASTE DISPOSAL COORDINATOR, 1700-H SLDS. GOLDENROD - (HWT/POI) ENGINEERING PLANNING, RM. 477, FEB-61SLD.					WHITE - ARMED SUPERVISOR OF BURIAL GROUND YELLOW - OUR WASTE DISPOSAL AND DECONTAMINATION, SEE SLDS. YELLOW - OUR WASTE DISPOSAL COORDINATOR, 1700-H SLDS. YELLOW - HWT/POI ENGINEERING PLANNING, RM. 477 FEB. 61SLD.	

54-2000-221 (3-68) 200-000, 0000

Figure 4-1. Solid Waste Burial Record (1968 to 1982). (Sheet 2 of 2)

TRANSURANIC DRY WASTE BURIALS

Shipment # 350 *RW# 234-5 Z-72-002*

NON-COMBUSTIBLE MATERIALS					Z-72- COMBUSTIBLE MATERIALS				
DRUM NO.	GMS. PU	REACT. METHOD	OPERATOR	TRENCH	DRUM NO.	GMS. PU	REACT. METHOD	OPERATOR	TRENCH
				8	7-1	0			
				9	7-2	1			
				10	7-3	4			
				11	7-4	0			
				12	7-5	1			
				13	7-6	0			
				14	7-7	0			
				15	7-8	0			
				16	7-9	0			
				17	7-10	0			
				18	7-11	4			
				19	7-12	0			
				20	7-13	3			
				21	7-14	6			
				22	7-15	0			
				23	7-16	7			
				24	7-17	0			
				25	7-18	0			
				26	7-19	0			
				27	7-20	0			
				28	7-21	18			
					TOTAL	44			

DATE 7-7-72
DISPOSAL SITE:

AREA	Shipment Number	TRECHES NO.
DISPOSAL NO.	CONTAINER NO.	
REMARKS:		
Signature		DATE

CERTIFIED BY: Fluoride Park
DISPOSAL SITE: SAFETY

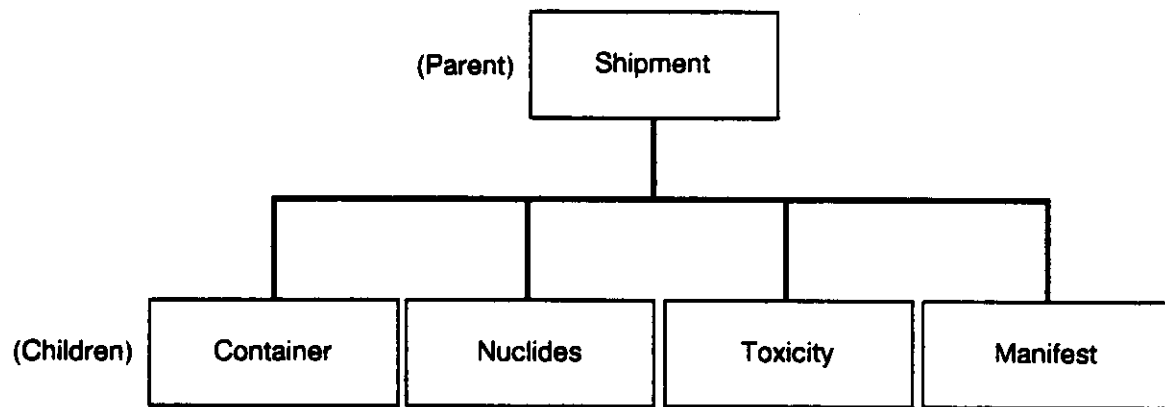
AREA	Shipment Number	TRECHES NO.
DISPOSAL NO.	CONTAINER NO.	
REMARKS:		
Signature		DATE

DRUMS ARE ACCEPTED PER
SOP 300.8

Russell P. Knight
SIGNATURE

7/7/72
DATE

Figure 4-3. Schematic for Richland-Solid Waste Information Management System Hierarchical Data Base.



PS89-3122-3

Table 4-1. Historical Changes Affecting Stored Waste Storage Records.

Occurrence	Time period
Transuranic (TRU) segregation based on generator practices (no concentration limit)	1970 to 1973
Classified waste emplaced with nonclassified waste	1970 to 1976
Organics absorbed on sawdust	~1970 to ~1975
TRU container burial and storage information based on a per-shipment basis	1970 to 1982
TRU waste-form description on a per-shipment basis	1970 to 1982
Segregated combustible and noncombustible	~1972 to ~1978
Fissile content on each container required	~1972 to Present
10 nCi/g TRU segregation limit	1973 to 1982
Recycled drums usage	~1973 to ~1978
Plywood and nylon tarps placed over drums and boxes	~1974* to Present
Criticality specification for drums up to 250 g	~1975 to 1978
Criticality specification for drums up to 200 g	1978 to Present
Container weight recorded on storage record	1977 to Present
Began storing classified waste separate from the asphalt pad in a vertical position	1976 to Present
Liquid organics banned from disposal and retrievable storage initiated	1979 to Present
Vent clips, etc., installed on other than Z-9 drums	1979 to Present
TRU waste-form description on an individual container basis	1982 to Present
Tamper-indicating seal on individual containers	1981 to Present
Galvanized drum usage	1981 to Present
100 nCi/g TRU segregation limit	1982 to Present
TRU container burial and storage information based on individual container records	1982 to Present
Mixed waste information on individual containers	1985 to Present

*Appears to vary by disposal area and containers stored.

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Figure 4.4. Solid Waste Storage Record-Transuranic (1985 to 1988).

Revised Worksheet Questions		SOLID WASTE STORAGE RECORD - TRANSURANIC									
UNIT SCALE: GALL, POUNDS PER GALL, CUBIC YARD		Container		2		Serial No.		1			
STORAGE SITE		This storage is used to store material from the following activity:				WASTE IDENTIFIABLE		3			
Area		33		34		35		36		37	
36		37		38		39		40		41	
42		43		44		45		46		47	
48		49		50		51		52		53	
54		55		56		57		58		59	
60		61		62		63		64		65	
66		67		68		69		70		71	
72		73		74		75		76		77	
78		79		80		81		82		83	
84		85		86		87		88		89	
90		91		92		93		94		95	
96		97		98		99		100		101	
102		103		104		105		106		107	
108		109		110		111		112		113	
114		115		116		117		118		119	
120		121		122		123		124		125	
126		127		128		129		130		131	
132		133		134		135		136		137	
138		139		140		141		142		143	
144		145		146		147		148		149	
150		151		152		153		154		155	
156		157		158		159		160		161	
162		163		164		165		166		167	
168		169		170		171		172		173	
174		175		176		177		178		179	
180		181		182		183		184		185	
186		187		188		189		190		191	
192		193		194		195		196		197	
198		199		200		201		202		203	
204		205		206		207		208		209	
210		211		212		213		214		215	
216		217		218		219		220		221	
222		223		224		225		226		227	
228		229		230		231		232		233	
234		235		236		237		238		239	
240		241		242		243		244		245	
246		247		248		249		250		251	
252		253		254		255		256		257	
258		259		260		261		262		263	
264		265		266		267		268		269	
270		271		272		273		274		275	
276		277		278		279		280		281	
282		283		284		285		286		287	
288		289		290		291		292		293	
294		295		296		297		298		299	
300		301		302		303		304		305	
306		307		308		309		310		311	
312		313		314		315		316		317	
318		319		320		321		322		323	
324		325		326		327		328		329	
330		331		332		333		334		335	
336		337		338		339		340		341	
342		343		344		345		346		347	
348		349		350		351		352		353	
354		355		356		357		358		359	
360		361		362		363		364		365	
366		367		368		369		370		371	
372		373		374		375		376		377	
378		379		380		381		382		383	
384		385		386		387		388		389	
390		391		392		393		394		395	
396		397		398		399		400		401	
402		403		404		405		406		407	
408		409		410		411		412		413	
414		415		416		417		418		419	
420		421		422		423		424		425	
426		427		428		429		430		431	
432		433		434		435		436		437	
438		439		440		441		442		443	
444		445		446		447		448		449	
450		451		452		453		454		455	
456		457		458		459		460		461	
462		463		464		465		466		467	
468		469		470		471		472		473	
474		475		476		477		478		479	
480		481		482		483		484		485	
486		487		488		489		490		491	
492		493		494		495		496		497	
498		499		500		501		502		503	
504		505		506		507		508		509	
510		511		512		513		514		515	
516		517		518		519		520		521	
522		523		524		525		526		527	
528		529		530		531		532		533	
534		535		536		537		538		539	
540		541		542		543		544		545	
546		547		548		549		550		551	
552		553		554		555		556		557	
558		559		560		561		562		563	
564		565		566		567		568		569	
570		571		572		573		574		575	
576		577		578		579		580		581	
582		583		584		585		586		587	
588		589		590		591		592		593	
594		595		596		597		598		599	
600		601		602		603		604		605	
606		607		608		609		610		611	
612		613		614		615		616		617	
618		619		620		621		622		623	
624		625		626		627		628		629	
630		631		632		633		634		635	
636		637		638		639		640		641	
642		643		644		645		646		647	
648		649		650		651		652		653	
654		655		656		657		658		659	
660		661		662		663		664		665	
666		667		668		669		670		671	
672		673		674		675		676		677	
678		679		680		681		682		683	
684		685		686		687		688		689	
690		691		692		693		694		695	
696		697		698		699		700		701	
702		703		704		705		706		707	
708		709		710		711		712		713	
714		715		716		717		718		719	
720		721		722		723		724		725	
726		727		728		729		730		731	
732		733		734		735		736		737	
738		739		740		741		742		743	
744		745		746		747		748		749	
750		751		752		753		754		755	
756		757		758		759		760		761	
762		763		764		765		766		767	
768		769		770		771		772		773	
774		775		776		777		778		779	
780		781		782		783		784		785	
786		787		788		789		790		791	
792		793		794		795		796		797	
798		799		800		801		802		803	
804		805		806		807		808		809	
810		811		812		813		814		815	
816		817		818		819		820		821	
822		823		824		825		826		827	
828		829		830		831		832		833	
834		835		836		837		838		839	
840		841		842		843		844		845	
846		847		848		849		850		851	
852		853		854		855		856		857	
858		859		860		861		862		863	
864		865		866		867		868		869	
870		871		872		873		874		875	
876		877		878		879		880		881	
882		883		884		885		886		887	
888		889		890		891		892		893	
894		895		896		897		898		899	
900		901		902		903		904		905	
906		907		908		909		910		911	
912		913		914		915		916		917	
918		919		920		921		922		923	
924		925		926		927		928		929	
930		931		932		933		934		935	
936		937		938		939		940		941	
942		943		944		945		946		947	

White - Solid Waste Engineering (R2-R2) Yellow - Solid Waste Operations Pink - Return to Shipper Goldenrod - Retained by Shipper 54-6000-226 (09/90)

**Table 4-2. Cubic Feet of Retrievably-Stored, Transuranic Waste
(1970 to December 31, 1988).**

Year	Yearly	Cumulative
1970	26,600	26,600
1971	30,400	57,000
1972	29,400	86,400
1973	15,600	102,000
1974*	24,400	126,400
1975	77,000	203,400
1976	34,000	237,400
1977	19,100	256,500
1978	27,400	283,900
1979	24,500	308,400
1980	57,400	365,800
1981*	45,900	411,700
1982*	39,100	450,800
1983*	26,800	477,600
1984*	20,500	498,100
1985	29,600	527,700
1986	7,600	535,300
1987*	6,100	541,500
1988	3,000	544,500

NOTE: Data from data base have been rounded off to three significant figures. Includes contact-handled transuranic (CH-TRU) waste, remote-handled transuranic (RH-TRU) waste, and waste that would be designated as low-level waste (LLW) under current U.S. Department of Energy (DOE) Orders.

*Volume includes small quantities of research reactor fuel waste.

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**Table 4-3. Percentage of Retrievably Stored, Transuranic Waste by Generating Source
(1970 to December 31, 1988).**

Generating source	% of total volume
234-5 Building [Plutonium Finishing Plant (PFP)]	53.6
231-Z Building [Pacific Northwest Laboratory (PNL)]	8.2
202-A and 202-AL Buildings [Plutonium-Uranium Extraction (PUREX) Facility and PUREX Laboratory]	7.2
Westinghouse Advanced Reactor Division, Cheswick, Pennsylvania	5.7
325 Building [Westinghouse Hanford Company (Westinghouse Hanford)]	4.4
General Electric, Vallecitos, California	3.8
Babcock & Wilcox, Appolla, Pennsylvania	2.5
325 Building [Pacific Northwest Laboratories (PNL)]	2.4
Kerr McGee, Crescent, Oklahoma	1.7
Hanford Engineering Development Laboratory [HEDL], Westinghouse Hanford	1.4
200 West Area (J. A. Jones)	1.1

NOTE: Greater than 1% of total. See Appendix A for complete listing.

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Table 4-4. Summary Totals and Averages--Transuranic Grams, Radiation Level, and Mixed Waste Designation.

Years	Container type	Total number of containers	Average transuranic (g)	Total transuranic (g)	Average radiation level	No. of containers with mixed waste	Average alpha (Ci)	Total alpha (Ci)	Average % noncombustible	Average % combustible
1970 to 1988	Casks ^b	39	3.631 E + 02	1.416 E + 04	2.056 E + 02	14	3.021 E + 01	1.178 E + 03	82	18
1970 to 1988	Concrete ^c box	58	8.167 E + 01	4.737 E + 03	4.050 E + 02	58	6.821 E + 00	3.956 E + 02	31	69
1970 to 1988	Fiber glass-reinforced polyester	202	4.394 E + 01	8.876 E + 03	9.838 E + 01	202	3.669 E + 00	7.412 E + 02	66	34
1970 to 1988	Metal box	329	5.191 E + 01	1.708 E + 04	2.499 E + 01	317	4.271 E + 00	1.405 E + 03	76	24
1970 to 1988	Other	423	4.095 E + 01	1.732 E + 04	4.621 E + 01	413	3.149 E + 00	1.332 E + 03	67	33
1970 to 1988	Plywood box	37	1.444 E + 00	5.344 E + 01	8.099 E + 02	37	5.886 E + 02	2.178 E + 04	13	87
1970 ^a to 1988	55-gal drum ^b	37,629	1.110 E + 01	4.177 E + 05	1.157 E + 01	36,843	9.158 E - 01	3.446 E + 04	35	65
1970 to 1988	Subvalues ^a	38,717	1.240 E + 01	4.799 E + 05	1.406 E + 01	37,884	1.583 E + 00	6.129 E + 04	36	64
1970 to 1988	55-gal drum	12	4.358 E + 02	5.230 E + 03	1.000 E + 00	12	1.319 E + 03	1.583 E + 04	100	0
1970 to 1988	Total values	38,729		4.852 E + 05		37,896		7.712 E + 04		

^aDoes not contain 12 high ²³⁸Pu content drums from 234-5Z. Those drums are listed separately.^bEntries include small quantities of research reactor fuel waste in drums and casks.^cTwenty-two of the 58 concrete boxes contain research reactor fuel waste.

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Table 4-5. Waste Type Percentage.

Waste type	Drum percentage	Metal box percentage	Fiber glass-reinforced polyester box percentage
Foam	--	--	1.7
Metal	19.0	52.3	73.7
Stainless	3.0	12.5	--
Lead	Trace	Trace	--
Dirt	4.0	--	--
Filters	1.0	2.3	--
Wood	1.0	3.2	12.0
Rubber	8.0	0.6	--
Plastic	27.0	11.9	5.3
Paper	20.0	3.3	2.8
Cloth	6.0	0.8	0.2
Concrete	1.0	3.6	0.8
Cement	1.0	0.8	--
Oxide	1.0	--	--
Plexiglass	--	--	1.0
Glass	2.0	4.0	0.3
Absorbent	1.0	0.5	--
Other	4.0	4.2	2.2
% of total container*	49	62	65

NOTE: No information available prior to January 1978. No information available for contents in plywood and concrete boxes. The above waste content information is based on the noted percentage of containers. Tables 35 through 40 provide the percentage of combustible and noncombustible waste in each of the container categories.

*NOTE: The "% of total container" represents the void space within the container.

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Table 4-6. Container Type Placed in Retrievable Storage (1970 to December 31,1988).

Type	Quantity	Volume (ft ³)	Volume (m ³)
Miscellaneous containers			
Miscellaneous cardboard boxes ^a	27	1.507 E + 02	4.267 E + 00
Miscellaneous packages ^a	28	1.356 E + 03	3.841 E + 01
Miscellaneous cylindrical containers ^b	380	7.564 E + 03	2.142 E + 02
High-efficiency particulate air (HEPA) filters	27	8.524 E + 02	2.414 E + 01
Total miscellaneous containers	462	9.923 E + 03	2.810 E + 02
Total 55-gal drums ^b	37,641	2.791 E + 05	7.904 E + 03
Boxes			
Concrete ^b	58	7.024 E + 03	1.989 E + 02
Fiber glass-reinforced polyester (FRP)	202	1.728 E + 05	4.892 E + 03
Plywood	37	9.943 E + 03	2.816 E + 02
Metal	329	6.576 E + 04	1.862 E + 03
Total boxes	626	2.555 E + 05	7.235 E + 03
Total transuranic (TRU) containers	38,729	5.445 E + 05	1.542 E + 04

^aThese containers were used predominately in the early 1970s.

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^bSixteen casks, 22 concrete boxes, and 13 drums contain research reactor fuel waste.

Table 4-7. Drum Weight Distribution for Transuranic Waste.

Weight (lb)	Total number of containers				
	1970 to 1977	1978 to 1981	1982 to 1985	1986 to 1988	Total
<100	4	134	208	174	520
100 to <200	17,341	8,179	6,364	1,269	33,153
200 to <300	205	410	1,029	244	1,888
300 to <400	41	263	371	157	832
400 to <500	29	37	255	91	412
500 to <600	20	25	93	88	226
600 to <700	247	5	14	1	267 ^a
700 to <800	17	109	2	0	128 ^b
800 to <900	12	0	2	1	15 ^c
900 to <1,000 ^d	0	0	25	0	25 ^d
>1,000	2	1	87	85	175 ^e
Total	17,918 ^f	9,163	8,450	2,110	37,641 ^g

NOTE: The maximum weight is 2,818 lb (1 container). Previous maximum weight was 2,631 lb.

^aFourteen drums contain radioactive mixed waste (lead).

^bTwenty-three drums contain radioactive mixed waste (21-oil and 2-lead).

^cTwo drums contain radioactive mixed waste (lead).

^dTwenty-five drums contain radioactive mixed waste (lead).

^eOne hundred fifty-two drums >1,000 lb to <2,000 lb contain mixed waste (lead). Thirteen drums >2,000 lb to <2,400 lb contain research reactor fuel mixed waste (lead).

^fWeights are based on calculated or estimated values.

^gAverage weight of all drums was calculated to be 174 lb (from Table 4.17).

^hThose >900 lb are in the temporary staging area and Burial Ground 04C, Trench T01, T07, and T29.

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Table 4-8. Drum Weight Distribution for Transuranic Waste, Offsite Companies.

Weight (lb)	Total number of containers				
	1970 to 1977	1978 to 1981	1982 to 1985	1986 to 1988	Total
Offsite companies: APA, GE, KER, RI, WEC					
<100	0	125	4	0	129
100 to <200	92	853	893	3	1,841
200 to <300	63	243	659	103	1,068
300 to <400	17	73	323	137	550
400 to <500	13	36	224	86	359
500 to <600	10	25	89	88	212
600 to <700	7	4	0	1	12
700 to <800	15	1	0	0	16
>1,000	0	0	4	0	4
Total	217	1,360	2,196	418	4,191
Offsite companies: ILL, CAN					
<100	0	0	4	0	4
100 to <200	5	19	21	4	49
200 to <300	0	0	21	11	32
300 to <400	0	0	16	5	21
400 to <500	0	0	27	3	30
500 to <600	0	0	3	0	3
600 to <700	0	0	14	0	14
700 to <800	0	21	2	0	23
800 to <900	0	0	2	0	2
900 to <1,000	0	0	25	0	25
>1,000	0	0	80	72	152
Total	5	40	215	95	355

NOTE: The maximum weight for Babcock Wilcox (APA) is 350 lb and the previous weight was 350 lb. The maximum weight for General Electric (GE) is 549 lb and the previous weight was 536 lb. The maximum weight for Kerr McGee (KER) is 2,818 lb, the previous weight was 1,017 lb, and the next previous weight for KER was 637 lb. The maximum weight for Rockwell International (Rocky Flats) (RI) is 774 lb and the previous weight was 750 lb. The maximum weight for Ward, Cheswik, Pennsylvania (WEC) is 2,631 lb, the previous weight was 1,413 lb, and the next previous weight for WEC was 526 lb. The maximum weight for Argonne National Laboratories (ILL) is 1,448 lb and the previous weight was 1,446 lb. The maximum weight for Energy Systems Group (CAN) is 1,410 lb and the previous weight was 1,395 lb.

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Table 4-9. Drum Weight Distribution for Transuranic Waste, Onsite Companies.

Weight (lb)	Total number of containers				
	1970 to 1977	1978 to 1981	1982 to 1985	1986 to 1988	Total
<100	1	9	3	2	15
100 to <200	3,928	2,100	111	22	6,161
200 to <300	32	145	18	9	204
300 to <400	1	2	7	2	12
400 to <500	0	1	0	0	1
600 to <700	205	1	0	0	206
700 to <800	0	87	0	0	87
800 to <900	1	0	0	0	1
Total	4,168	2,345	139	35	6,687

NOTE: The maximum weight for J.A. Jones (JAJ) is 670 lb and the previous weight was 150 lb. The maximum weight for Pacific Northwest Laboratory (PNL) 231-Z is 260 lb and the previous weight was 257 lb. The maximum weight for PNL/325 is 348 lb and the previous weight was 300 lb. The maximum weight for PNL/340 is 679 lb and the previous weight was 332 lb. The maximum weight for Westinghouse Hanford Company (WHC) 216-Z9 is 400 lb and the previous weight was 207 lb. The maximum weight for Westinghouse Hanford/325 is 800 lb and the previous weight was 711 lb. The maximum weight for Westinghouse Hanford/340 is 384 lb and the previous weight was 351 lb. JAJ consisted of 111 drums at 150 lb. PNL/231-Z consisted of 1,323 drums at 150 lb. PNL/325 consisted of 1,546 drums at 150 lb. PNL/340 consisted of 72 drums at 150 lb. WHC/216-Z9 consisted of 561 drums at 150 lb. WHC/325 consisted of 2,256 drums at 150 lb. WHC/340 consisted of 115 drums at 150 lb. Refer to Appendix A.

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Table 4-10. Drum Weight Distribution for Transuranic Waste, Onsite for Westinghouse Hanford Company.

Weight (lb)	Total number of containers				
	1970 to 1977	1978 to 1981	1982 to 1985	1986 to 1988	Total
<100	3	0	183	169	355
100 to <200	12,563	5,042	5,143	1,154	23,902
200 to <300	0	0	307	105	412
300 to <400	1	1	22	7	31
400 to <500	0	0	4	1	5
800 to <900	1	0	0	0	1
>1,000	2	1	3	0	6
Total	12,570	5,044	5,662	1,436	24,712

NOTE: The maximum weight for WHC/202-A is 331 lb. The maximum weight for WHC/202-AL is 150 lb. The maximum weight for WHC/234-5Z is 476 lb and the previous weight was 425 lb.

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Table 4-11. Metal Box Weight Distribution for Transuranic Waste.

Weight (lb)	Total number of containers				
	1970 to 1977	1978 to 1981	1982 to 1985	1986 to 1988	Total
<5,000	87	29	80	5	201
5,000 to <10,000	19	9	60	1	89
10,000 to <15,000	11	2	10	0	23
15,000 to <20,000	6	3	3	0	12
25,000 to <30,000	1	0	1	0	2
30,000 to <50,000	2	0	0	0	2
Total	126	43	154	6	329

NOTE: The maximum weight of one container is 35,000 lb. The previous maximum weight was 31,360 lb.

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Table 4-12. Fiber Glass-Reinforced Polyester Box Weight Distribution for Transuranic Waste.

Weight (lb)	Total number of containers				
	1970 to 1977	1978 to 1981	1982 to 1985	1986 to 1988	Total
<5,000	18	44	40	0	102
5,000 to <10,000	2	5	0	0	7
10,000 to <15,000	2	17	0	0	19
15,000 to <20,000	3	11	0	0	14
20,000 to <25,000	5	13	0	0	18
25,000 to <30,000	1	1	0	0	2
30,000 to <50,000	21	0	0	0	21
50,000 to <70,000	18	0	0	0	18
70,000 to <90,000	0	1	0	0	1
Total	70	92	40	0	202

NOTE: The maximum weight of one container is 83,000 lb. The previous maximum weight was 58,830 lb.

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Table 4-13. Concrete Box Weight Distribution for Transuranic Waste.

Weight (lb)	Total number of containers				
	1970 to 1977 ^a	1978 to 1981	1982 to 1985	1986 to 1988	Total
<5,000	23	9	0	0	32
5,000 to <10,000	1	0	0	0	1
15,000 to <20,000	6 ^b	0	0	0	6
25,000 to <30,000	18 ^b	0	0	0	18
45,000 to <50,000	1	0	0	0	1
Total	49	9	0	0	58

NOTE: The maximum weight of one container (234-5Z) is 45,500 lb. The previous maximum weight was 27,000 lb. The majority of the waste is from General Electric, Vallecitos, California.

^aWeight is based on calculation.

^bTwenty-two contain research reactor fuel waste.

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Table 4-14. Plywood Box Weight Distribution for Transuranic Waste.

Weight (lb)	Total number of containers				
	1970 to 1977 ^a	1978 to 1981	1982 to 1985	1986 to 1988	Total
<5,000	21	1	0	0	22
5,000 to <10,000	6	0	0	0	6
15,000 to <20,000	3	0	0	0	3
20,000 to <25,000	2	0	0	0	2
25,000 to <30,000	1	0	0	0	1
30,000 to <35,000	1	0	0	0	1
35,000 to <40,000	1	0	0	0	1
>55,000	1	0	0	0	1
Total	36	1	0	0	37

NOTE: The maximum weight for one container is 55,440 lb. The previous maximum weight was 39,240 lb.

^aWeight is based on calculation.

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Table 4-15. Transuranic Waste--Dose Rate Breakdown and Number of Containers by Container Type. (Sheet 1 of 2)

Dose rate (mrem)	Casks	Concrete boxes	Fiber glass-reinforced polyester boxes	Metal boxes	Other	Plywood boxes	55-gal drum	Total
1970 to 1973								
≤ 5	0	5	0	79	91	1	9,813	9,989
> 5 to ≤ 10	0	0	0	0	41	0	465	506
> 10 to ≤ 20	0	0	0	2	1	0	111	114
> 20 to ≤ 50	0	0	0	0	3	0	122	125
> 50 to ≤ 100	0	0	0	0	1	0	93	94
> 100 to ≤ 150	0	0	0	0	1	0	20	21
> 150 to ≤ 200	0	0	0	0	0	0	33	33
> 200 to ≤ 250	0	0	0	0	0	0	3	3
> 250	0	16	0	3	6	0	92	117
No value	0	1	0	3	5	15	176	200
Subtotal	0	22	0	87	149	16	10,928	11,202
1974 to 1977								
≤ 5	0	4	38	19	44	0	5,980	6,085
> 5 to ≤ 10	0	9	1	2	14	5	213	244
> 10 to ≤ 20	0	4	0	0	0	0	39	43
> 20 to ≤ 50	1	4	0	7	1	0	44	57
> 50 to ≤ 100	0	4	3	0	4	0	19	30
> 100 to ≤ 150	0	0	0	0	0	0	6	6
> 150 to ≤ 200	3	0	0	0	2	2	21	28
> 200 to ≤ 250	5	0	0	0	1	1	2	9
> 250	2	1	2	0	2	12	25	44
No value	0	1	26	11	1	0	641	680
Subtotal	11	27	70	39	69	20	6,990	7,226
1978 to 1981								
≤ 5	1	0	70	35	38	0	8,625	8,769
> 5 to ≤ 10	2	1	3	2	32	1	476	517
> 10 to ≤ 20	0	2	0	6	6	0	3	17
> 20 to ≤ 50	5	0	1	0	14	0	6	26
> 50 to ≤ 100	0	6	1	0	3	0	1	11
> 100 to ≤ 150	4	0	0	0	0	0	9	13
> 150 to ≤ 200	1	0	0	0	1	0	0	2

Table 4-15. Transuranic Waste--Dose Rate Breakdown and Number of Containers by Container Type. (Sheet 2 of 2)

Dose rate (mrem)	Casks	Concrete boxes	Fiber glass-reinforced polyester boxes	Metal boxes	Other	Plywood boxes	55-gal drum	Total
1978 to 1981 (cont.)								
>250	0	0	5	0	0	0	1	6
No value	0	0	12	0	1	0	42	55
Subtotal	13	9	92	43	95	1	9,163	9,416
1982 to 1985								
≤5	0	0	40	145	105	0	7,614	7,904
>5 to ≤10	0	0	0	4	2	0	488	494
>10 to ≤20	2	0	0	1	0	0	144	147
>20 to ≤50	0	0	0	0	3	0	82	85
>50 to ≤100	2	0	0	1	0	0	53	56
>100 to ≤150	2	0	0	0	0	0	37	39
>150 to ≤200	1	0	0	1	0	0	29	31
>200 to ≤250	1	0	0	0	0	0	0	1
No value	0	0	0	2	0	0	3	5
Subtotal	8	0	40	154	110	0	8,450	8,762
1986 to 1988								
≤5	0	0	0	3	0	0	1,774	1,777
>5 to ≤10	1	0	0	2	0	0	146	149
>10 to ≤20	0	0	0	1	0	0	52	53
>20 to ≤50	3	0	0	0	0	0	80	83
>50 to ≤100	1	0	0	0	0	0	27	28
>100 to ≤150	1	0	0	0	0	0	4	5
>150 to ≤200	1	0	0	0	0	0	3	4
≤250	0	0	0	0	0	0	1	1
No value	0	0	0	0	0	0	23	23
Subtotal	7	0	0	6	0	0	2,110	2,123
Grand total	39	58	202	329	423	37	37,641	38,729

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Table 4-16. Transuranic Waste--Dose Rates Breakdown and Number of Containers by Container Type and Generator (1970 to December 31, 1988). (Sheet 1 of 5)

Dose rate (mrem)	Casks	Concrete boxes	Fiber glass-reinforced polyester boxes	Metal boxes	Other	Plywood boxes	55-gal drum	Total
Waste generator--Babcock Wilcox, Appolla, Pennsylvania								
≤5	0	0	0	22	1	0	1,104	1,127
>5 to ≤10	0	0	0	2	0	0	9	11
>10 to ≤20	0	0	0	0	0	0	10	10
>20 to ≤50	0	0	0	0	0	0	8	8
>50 to ≤100	0	0	0	0	0	0	2	2
>100 to ≤150	0	0	0	0	0	0	2	2
>150 to ≤200	0	0	0	1	0	0	10	11
No value	0	0	0	0	0	0	2	2
Subtotal	0	0	0	25	1	0	1,147	1,173
Waste generator--University of California, Lawrence Berkeley Laboratories								
>150 to ≤200	0	0	0	0	0	0	1	1
Subtotal	0	0	0	0	0	0	1	1
Waste generator--Bartleville Energy Technology Center								
≤5	0	0	0	0	0	0	1	1
No value	0	0	0	0	0	0	2	2
Subtotal	0	0	0	0	0	0	3	3
Waste generator--Energy Systems Group, Canoga Park								
≤5	0	0	0	0	0	0	127	127
>5 to ≤10	0	0	0	0	0	0	5	5
>10 to ≤20	0	0	0	0	0	0	3	3
>20 to ≤50	0	0	0	0	0	0	17	17
>50 to ≤100	0	0	0	0	0	0	36	36
>100 to ≤150	0	0	0	0	0	0	29	29
>150 to ≤200	0	0	0	0	0	0	19	19
Subtotal	0	0	0	0	0	0	236	236
Waste generator--Dow Chemical (Rocky Flats), Golden, Colorado								
≤5	0	0	0	0	0	0	209	209
Subtotal	0	0	0	0	0	0	209	209

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Table 4-16. Transuranic Waste--Dose Rates Breakdown and Number of Containers by Container Type and Generator (1970 to December 31, 1988). (Sheet 2 of 5)

Dose rate (mrem)	Casks	Concrete boxes	Fiber glass-reinforced polyester boxes	Metal boxes	Other	Plywood boxes	55-gal drum	Total
Waste generator--Exxon Nuclear Systems, Richland, Washington								
≤5	0	0	0	0	0	0	201	201
>5 to ≤10	0	0	0	0	0	0	1	1
No value	0	0	0	0	0	0	1	1
Subtotal	0	0	0	0	0	0	203	203
Waste generator--General Electric, Vallejos, California								
≤5	0	4	43	0	0	0	150	197
>5 to ≤10	0	8	0	0	0	0	0	8
>10 to ≤20	0	4	0	0	0	0	0	4
>20 to ≤50	0	3	0	0	0	0	0	3
>50 to ≤100	2	1	0	0	0	0	0	3
>100 to ≤150	2	0	0	0	0	0	0	2
>150 to ≤200	1	0	0	0	0	0	0	1
>200 to ≤250	1	0	0	0	0	0	0	1
>250	0	1	0	0	0	0	0	1
No value	0	1	0	0	0	0	0	1
Subtotal	6	22*	43	0	0	0	150	221
Waste generator--General Electric, San Jose, California								
No value	0	0	0	0	0	0	16	16
Subtotal	0	0	0	0	0	0	16	16
Waste generator--Argonne National Laboratories, Argonne, Illinois								
≤5	0	0	0	0	0	0	1	1
>10 to ≤20	0	0	0	0	0	0	20	20
>20 to ≤50	0	0	0	0	0	0	71	71
>50 to ≤100	0	0	0	0	0	0	20	20
>100 to ≤150	0	0	0	0	0	0	1	1
≤250	0	0	0	0	0	0	1	1
No value	0	0	0	0	0	0	5	5
Subtotal	0	0	0	0	0	0	119	119

*Contain research reactor fuel waste.

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Table 4-16. Transuranic Waste--Dose Rates Breakdown and Number of Containers by Container Type and Generator (1970 to December 31, 1988). (Sheet 3 of 5)

Dose rate (mrem)	Casks	Concrete boxes	Fiber glass-reinforced polyester boxes	Metal boxes	Other	Plywood boxes	55-gal drum	Total
Waste generator--J. A. Jones, Richland, Washington								
≤5	0	0	3	5	5	0	255	268
>5 to ≤10	0	0	0	0	0	0	20	20
>20 to ≤50	0	0	0	0	0	0	17	17
>50 to ≤100	0	0	3	0	0	0	1	4
>150 to ≤200	0	0	0	0	0	0	20	20
Subtotal	0	0	6	5	5	0	313	329
Waste generator--Kerr McGee, Crescent, Oklahoma								
≤5	0	0	0	0	0	0	972	972
>5 to ≤10	0	0	0	0	0	0	182	182
>10 to ≤20	0	0	0	0	0	0	61	61
>20 to ≤50	0	0	0	0	0	0	3	3
>100 to ≤150	0	0	0	0	0	0	2	2
No value	0	0	0	0	0	0	1	1
Subtotal	0	0	0	0	0	0	1,221	1,221
Waste generator--Lawrence Livermore Laboratory								
≤5	0	0	0	0	0	0	3	3
Subtotal	0	0	0	0	0	0	3	3
Waste generator--Ceer University, Mayaguez, Puerto Rico								
>20 to ≤50	0	0	0	0	0	0	1	1
Subtotal	0	0	0	0	0	0	1	1
Waste generator--Battelle, Columbus, Ohio								
≤5	0	0	0	6	0	0	82	88
>150 to ≤200	1	0	0	0	0	0	0	1
No value	0	0	0	0	0	0	1	1
Subtotal	1	0	0	6	0	0	83	90
Waste generator--Pacific Northwest Laboratory, Richland, Washington								
≤5	0	0	19	34	29	0	3,115	3,197
>5 to ≤10	0	1	0	2	35	0	205	243
>10 to ≤20	0	0	0	1	0	0	39	40
>20 to ≤50	7	0	1	0	0	0	25	33
>50 to ≤100	0	3	0	0	0	0	21	24
>100 to ≤150	4	0	0	0	0	0	7	11

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Table 4-16. Transuranic Waste--Dose Rates Breakdown and Number of Containers by Container Type and Generator (1970 to December 31, 1988). (Sheet 4 of 5)

Dose rate (mrem)	Casks	Concrete boxes	Fiber glass-reinforced polyester boxes	Metal boxes	Other	Plywood boxes	55-gal drum	Total
Waste generator--Pacific Northwest Laboratory, Richland, Washington (cont.)								
>150 to ≤200	4	0	0	0	0	0	1	5
>200 to ≤250	5	0	0	0	0	0	0	5
>250	2	0	0	0	0	0	0	2
No value	0	0	0	0	0	0	26	26
Subtotal	22	4	20	37	64	0	3,439	3,586
Waste generator--Rockwell International (RI) (Rocky Flats), Golden, Colorado								
≤5	0	0	0	0	0	0	735	735
>20 to ≤50	0	0	0	0	0	0	4	4
No value	0	0	0	0	0	0	25	25
Subtotal	0	0	0	0	0	0	764	764
Waste generator--International Atomic Energy Agency, Seibersdorf, Austria								
≤5	0	0	0	0	0	0	1	1
Subtotal	0	0	0	0	0	0	1	1
Waste generator--Ward, Cheswick, Pennsylvania								
≤5	0	0	23	91	0	0	815	929
>5 to ≤10	0	0	0	0	0	0	75	75
>10 to ≤20	0	0	0	0	0	0	2	2
>20 to ≤50	0	0	0	0	0	0	7	7
>50 to ≤100	0	0	0	0	0	0	4	4
>100 to ≤150	0	0	0	0	0	0	3	3
>150 to ≤200	0	0	0	0	0	0	2	2
No value	0	0	0	0	0	0	1	1
Subtotal	0	0	23	91	0	0	909	1,023
Waste generator--Westinghouse Hanford Company, Richland, Washington								
≤5	1	5	60	123	243	1	26,035	26,468
>5 to ≤10	3	1	4	6	54	6	1,291	1,365
>10 to ≤20	2	2	0	9	7	0	214	234
>20 to ≤50	2	1	0	7	21	0	181	212
>50 to ≤100	1	6	1	1	8	0	109	126
>100 to ≤150	1	0	0	0	1	0	32	34

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Table 4-16. Transuranic Waste--Dose Rates Breakdown and Number of Containers by Container Type and Generator (1970 to December 31, 1988). (Sheet 5 of 5)

Dose rate (mrem)	Casks	Concrete boxes	Fiber glass-reinforced polyester boxes	Metal boxes	Other	Plywood boxes	55-gal drum	Total
Waste generator--Westinghouse Hanford Company, Richland, Washington (cont.)								
>150 to ≤200	0	0	0	0	3	2	33	38
>200 to ≤250	0	0	0	0	1	1	5	7
>250	0	16	7	3	8	12	118	164
No value	0	1	38	16	7	15	805	882
Subtotal	10	032	110	165	353	37	28,823	29,530
Grand total	39	58	202	329	423	37	37,641	38,729

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Table 4-17. Transuranic (TRU) Grams per 55-gal Drum. (Sheet 1 of 2)

Time span	TRU grams range	Number of containers	Average weight of containers (lb)	Average volume of containers (ft ³)
1970 to 1977	<0.100	10,415	1.542 E + 02	7.419 E + 00
	0.100 to <001	1,129	1.507 E + 02	7.400 E + 00
	001 to <010	5,153	1.727 E + 02	7.400 E + 00
	010 to <050	956	1.591 E + 02	7.410 E + 00
	050 to <075	121	1.707 E + 02	7.400 E + 00
	075 to <100	72	1.510 E + 02	7.400 E + 00
	100 to <150	25	3.146 E + 02	7.400 E + 00
	150 to <200	43	4.901 E + 02	7.400 E + 00
	200 to <250	4	4.335 E + 02	7.400 E + 00
1978 to 1981	<0.100	4,294	1.557 E + 02	7.402 E + 00
	0.100 to <001	275	1.949 E + 02	7.432 E + 00
	001 to <010	1,520	1.935 E + 02	7.411 E + 00
	010 to <050	1,589	1.519 E + 02	7.440 E + 00
	050 to <075	341	1.508 E + 02	7.400 E + 00
	075 to <100	266	1.517 E + 02	7.401 E + 00
	100 to <150	287	1.605 E + 02	7.400 E + 00
	150 to <200	568	2.254 E + 02	7.402 E + 00
	200 to <250	12	1.667 E + 02	8.017 E + 00
	250 to <300	1	1.500 E + 02	7.400 E + 00
	300 to <350	1	1.500 E + 02	7.400 E + 00
	350 to <550	9	1.500 E + 02	7.400 E + 00
1982 to 1985	<0.100	2,908	1.517 E + 02	7.418 E + 00
	0.100 to <001	413	2.367 E + 02	7.451 E + 00
	001 to <010	3,774	2.054 E + 02	7.422 E + 00
	010 to <050	899	2.518 E + 02	7.424 E + 00
	050 to <075	102	1.672 E + 02	7.413 E + 00
	075 to <100	84	1.641 E + 02	7.413 E + 00
	100 to <150	138	1.663 E + 02	7.413 E + 00
	150 to <200	115	1.617 E + 02	7.415 E + 00
	200 to <250	17	1.494 E + 02	7.424 E + 00

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Table 4-17. Transuranic (TRU) Grams per 55-gal Drum. (Sheet 2 of 2)

Time span	TRU grams range	Number of containers	Average weight of containers	Average volume of containers
1986 to 1988	<0.100	191	1.501 E + 02	7.416 E + 00
	0.100 to <001	147	3.466 E + 02	7.416 E + 00
	001 to <010	1,033	2.920 E + 02	7.464 E + 00
	010 to <050	363	2.296 E + 02	7.416 E + 00
	050 to <075	89	1.628 E + 02	7.416 E + 00
	075 to <100	81	1.570 E + 02	7.416 E + 00
	100 to <150	141	1.661 E + 02	7.381 E + 00
	150 to <200	63	1.665 E + 02	7.416 E + 00
	200 to <250	1	1.896 E + 02	7.416 E + 00
	300 to <350	1	2.425 E + 02	7.416 E + 00
Column totals	--	37,641	--	--
Total weight and volume	--	--	6.549 E + 06	2.791 E + 05
Averages	--	--	1.740 E + 02	7.415 E + 00

NOTE: Includes 12 drums of high ^{238}Pu -content from 234-5Z.

NOTE: The information contained in this table, especially the volumes, should be called into question due to the suspicious variance in the containers' average volumes.

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Table 4-18. Transuranic (TRU) Grams per Metal Box.

Time span	TRU grams range	Number of containers	Average weight of containers (lb)	Average volume of containers (ft ³)
1970 to 1977	<0.100	53	2.653 E + 03	9.465 E + 01
	0.100 to <001	17	3.114 E + 03	1.112 E + 02
	001 to <010	32	6.141 E + 03	2.193 E + 02
	010 to <050	10	5.605 E + 03	2.110 E + 02
	050 to <075	2	5.714 E + 03	2.040 E + 02
	075 to <100	1	1.792 E + 03	6.400 E + 01
	100 to <150	4	1.420 E + 04	4.795 E + 02
	150 to <200	2	4.368 E + 03	1.560 E + 02
	200 to <250	3	9.697 E + 03	3.463 E + 02
	250 to <300	1	5.376 E + 03	1.920 E + 02
	350 and <2,200	1	8.680 E + 03	3.100 E + 02
1978 to 1981	<0.100	7	5.662 E + 03	2.372 E + 02
	0.100 to <001	7	1.344 E + 03	3.500 E + 01
	001 to <010	12	4.288 E + 03	1.822 E + 02
	010 to <050	14	3.456 E + 03	1.250 E + 02
	050 to <075	1	1.500 E + 04	4.600 E + 02
	200 to <250	2	6.618 E + 03	2.360 E + 02
1982 to 1985	<0.100	7	6.193 E + 03	2.706 E + 02
	0.100 to <001	1	2.106 E + 03	1.250 E + 02
	001 to <010	67	5.045 E + 03	2.475 E + 02
	010 to <050	37	5.344 E + 03	2.121 E + 02
	050 to <075	2	1.250 E + 04	4.154 E + 02
	075 to <100	12	7.087 E + 03	2.571 E + 02
	100 to <150	8	6.493 E + 03	2.547 E + 02
	150 to <200	6	6.530 E + 03	2.053 E + 02
	200 to <250	2	9.189 E + 03	4.374 E + 02
	250 to <300	2	5.904 E + 03	2.348 E + 02
	300 to <350	4	5.137 E + 03	2.578 E + 02
	350 and <2,200	6	6.475 E + 03	2.984 E + 02
1986 to 1988	010 to <050	1	3.796 E + 03	1.130 E + 02
	150 to <200	1	3.329 E + 03	1.130 E + 02
	200 to <250	3	3.209 E + 03	1.130 E + 02
	250 to <300	1	6.865 E + 03	3.390 E + 02
Column totals	--	329	--	--
Total weight and volume	--	--	1.641 E + 06	6.576 E + 04
Grand averages	--	--	4.987 E + 03	1.999 E + 02

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Table 4-19. Transuranic (TRU) Grams per Fiber Glass-Reinforced Polyester Box.

Time span	TRU grams range	Number of containers	Average weight of containers (lb)	Average volume of containers (ft ³)
1970 to 1977	<0.100	3	1.288 E + 04	4.600 E + 02
	0.001 to <010	23	1.592 E + 04	6.927 E + 02
	010 to <050	14	2.500 E + 04	1.067 E + 03
	050 to <075	5	4.783 E + 04	1.957 E + 03
	075 to <100	5	3.864 E + 04	1.562 E + 03
	100 to <150	7	3.490 E + 04	1.358 E + 03
	150 to <200	3	3.566 E + 04	1.511 E + 03
	200 to <250	3	4.661 E + 04	1.665 E + 03
	250 to <300	2	4.006 E + 04	1.431 E + 03
	350 and <500	5	4.719 E + 04	1.685 E + 03
1978 to 1981	<0.100	17	5.524 E + 03	5.343 E + 02
	0.100 to <001	7	4.183 E + 03	3.351 E + 02
	001 to <010	29	1.060 E + 04	7.503 E + 02
	010 to <050	23	9.994 E + 04	9.513 E + 02
	050 to <075	5	1.506 E + 04	1.292 E + 03
	075 to <100	2	1.175 E + 04	1.343 E + 03
	100 to <150	3	3.808 E + 04	1.646 E + 03
	150 to <200	3	1.587 E + 04	1.472 E + 03
	200 to <250	1	2.000 E + 04	2.281 E + 03
	250 to <300	1	1.220 E + 04	1.535 E + 03
	350 to <500	1	2.128 E + 04	7.600 E + 02
1982 to 1985	<0.100	31	3.997 E + 03	3.858 E + 02
	0.100 to <001	8	3.871 E + 03	2.754 E + 02
	001 to <010	1	4.774 E + 03	3.040 E + 02
Column totals	--	202	--	--
Total weight and volume	--	--	3.128 E + 06	1.728 E + 05
Averages	--	--	1.549 E + 04	8.553 E + 02

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Table 4-20. Transuranic (TRU) Grams per Concrete Box.

Time span	TRU grams range	Number of containers	Average weight of containers (lb)	Average volume of containers (ft ³)
1970 to 1977	<0.100	19	1.744 E + 03	2.411 E + 01
	0.100 to <001	4	2.809 E + 03	5.475 E + 01
	001 to <010	4	1.477 E + 04	1.883 E + 02
	010 to <050	4	3.163 E + 04	5.473 E + 02
	050 to <075	4	2.475 E + 04	1.713 E + 02
	075 to <100	6	2.400 E + 04	1.657 E + 02
	100 to <150	4	2.700 E + 04	1.880 E + 02
	200 to <250	1	2.700 E + 04	1.880 E + 02
	350 to <1,100	3	2.700 E + 04	1.880 E + 02
1978 to 1981	<0.100	2	5.400 E + 02	2.700 E + 01
	001 to <010	7	2.268 E + 03	2.399 E + 01
Column totals	--	58	--	--
Total weight and volume	--	--	7.059 E + 05	7.024 E + 03
Grand averages	--	--	1.217 E + 04	1.211 E + 02

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Table 4-21. Transuranic (TRU) Grams per Plywood Box.

Time span	TRU grams range	Number of containers	Average weight of containers (lb)	Average volume of containers (ft ³)
1970 to 1977	<0.100	2	1.022 E + 04	2.910 E + 02
	0.100 to <001	19	1.693 E + 03	6.653 E + 01
	001 to <010	13	1.515 E + 04	4.344 E + 02
	010 to <050	2	4.115 E + 04	1.143 E + 03
1978 to 1981	001 to <010	1	4.400 E + 03	1.640 E + 02
Column totals	--	37	--	--
Total weight and volume	--	--	3.362 E + 05	9.943 E + 03
Grand averages	--	--	9.086 E + 03	2.687 E + 02

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Table 4-21A. Transuranic (TRU) Grams per Cask and Other Containers.

Time span	TRU grams range	Number of containers	Average weight of containers (lb)	Average volume of containers (ft ³)
1970 to 1977	<0.100	165	5.767 E + 02	2.222 E + 01
	0.100 to <001	18	4.718 E + 02	1.759 E + 01
	001 to <010	36	1.916 E + 03	6.954 E + 01
	010 to <050	2	3.000 E + 02	1.480 E + 01
	150 to <200	8	6.060 E + 02	1.480 E + 01
1978 to 1981	<0.100	21	3.935 E + 02	1.480 E + 01
	001 to <010	43	2.068 E + 03	2.572 E + 01
	010 to <050	22	3.804 E + 02	1.433 E + 01
	075 to <100	1	5.560 E + 02	4.500 E + 00
	100 to <150	5	4.936 E + 02	1.480 E + 01
	150 to <200	3	3.500 E + 02	4.500 E + 00
	200 to <250	4	3.500 E + 02	1.480 E + 01
	250 to <300	4	3.500 E + 02	1.480 E + 01
	300 to <350	2	3.500 E + 02	1.480 E + 01
	350 to <3,000	3	5.500 E + 03	2.454 E + 01
1982 to 1985	<0.100	75	3.192 E + 02	6.689 E + 00
	001 to <010	7	2.414 E + 02	6.300 E + 00
	010 to <050	2	4.250 E + 02	4.600 E + 00
	050 to <075	2	4.500 E + 02	4.700 E + 00
	075 to <100	4	5.500 E + 03	2.454 E + 01
	100 to <150	5	3.805 E + 03	1.732 E + 01
	250 to <300	2	3.675 E + 02	1.480 E + 01
	300 to <350	1	3.000 E + 02	1.480 E + 01
	350 to <3,000	20	6.005 E + 02	1.492 E + 01
1986 to 1988	<0.100	1	3.461 E + 03	2.013 E + 01
	001 to <010	1	6.400 E + 03	2.860 E + 01
	350 to <3,000	5	4.989 E + 03	2.454 E + 01
Column totals	--	462	--	--
Total weight and volume	--	--	3.421 E + 05	9.923 E + 03
Grand averages	--	--	7.404 E + 05	2.148 E + 01

NOTE: The information in this table should be viewed with caution due to inconsistencies within the table itself. These inconsistencies are either within the table data or in the conclusions. The data required to find the error was not available at the time of this revision.

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Table 4-22. Isotopic Distribution for Transuranic Waste from 1970 to December 31, 1988^a.

Isotope	Gram quantity	Curie quantity (Ci)	Specific activity (Ci/g)	Activity (%)	Weight (%)
²⁴¹ Am	1.836 E + 02	6.304 E + 02	3.434 E + 00	--	--
²⁴³ Am	5.276 E + 01	9.761 E + 02	1.850 E + 01	--	--
¹⁴ C	--	1.600 E + 00	--	--	--
¹⁴¹ Ce	3.509 E - 08	1.000 E - 03	2.850 E + 04	--	--
¹⁴⁴ Ce, ¹⁴⁴ Pr	1.662 E + 01	5.302 E + 04	3.190 E + 03	4.0	--
²⁵² Cf	2.000 E + 00	1.290 E + 03	6.450 E + 02	--	--
²⁴⁵ Cm	4.822 E + 01	7.566 E + 00	1.569 E - 01	--	--
⁶⁰ Co	1.973 E + 00	2.232 E + 03	1.131 E + 03	0.2	--
¹³⁷ Cs, ¹³⁷ Ba	1.941 E + 02	1.679 E + 04	8.650 E + 01	1.3	--
¹⁵⁵ Eu	8.192 E - 02	3.810 E + 01	4.651 E + 02	--	--
³ H	7.057 E - 04	6.803 E + 00	9.640 E + 03	--	--
⁸⁵ Kr	9.506 E + 00	3.730 E + 03	3.924 E + 02	0.3	--
Li	5.900 E + 00	5.900 E + 00	1.000 E + 00	--	--
Mixed fission products	--	8.826 E + 05	--	66.4	--
²³⁷ Np	3.537 E + 02	2.493 E + 00	7.048 E - 03	--	--
¹⁴⁷ Pm	4.339 E + 01	4.023 E + 04	9.272 E + 02	3.0	--
²³⁸ Pu	5.293 E + 03	9.210 E + 04	1.740 E + 01	6.9	--
²³⁹ Pu	4.417 E + 05	2.712 E + 04	6.140 E - 02	2.0	2.2
²⁴⁰ Pu	2.702 E + 04	6.457 E + 03	2.390 E - 01	0.5	0.1
²⁴¹ Pu	1.599 E + 03	1.791 E + 05	1.120 E + 02	13.5	--
²⁴² Pu	9.413 E + 01	3.671 E - 01	3.900 E - 03	--	--
¹⁰⁶ Ru, ¹⁰⁶ Rh	1.581 E + 00	5.291 E + 03	3.347 E + 03	0.4	--
⁹⁰ Sr, ⁹⁰ Y	1.191 E + 02	1.654 E + 04	1.389 E + 02	1.2	--
Th	6.151 E + 05	6.748 E - 01	1.097 E - 06	--	3.1
U-D	1.450 E + 07	4.876 E - 01	3.363 E - 08	--	72.8
U-E	3.568 E + 05	7.714 E + 00	2.162 E - 05	--	1.8
U-N	3.966 E + 06	2.729 E + 00	6.881 E - 07	--	19.9
²³³ U	8.293 E + 03	7.994 E + 01	9.639 E - 03	0.1	--
Totals	1.992 E + 07	1.328 E + 06	--	--	--

^aNot including 12 drums of high-²³⁸Pu content from 234-5Z.

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Table 4-23. Transuranic (TRU) Waste from 234-5Z Containing High Quantities of ^{238}Pu .

Disposal date	Shipment number	Container code	Amount of containers	Volume (ft ³)	Weight (lb)	Total dose rate (mrem)	Non-combustible (%)	Content	Content (%)	Pu	Mixed fission products	^{238}Pu
10/28/80	801541	CB	1	7.400 E + 00	1.500 E + 02	1.000 E + 00	100	Metal	100	1.000 E - 04	1.000 E - 03	5.125 E + 02
10/8280	801542	CB	1	7.400 E + 00	1.500 E + 02	1.000 E + 00	100	Metal	100	1.000 E - 04	1.000 E - 03	5.150 E + 02
10/28/80	801543	CB	1	7.400 E + 00	1.500 E + 02	1.000 E + 00	100	Metal	100	1.000 E - 04	1.000 E - 03	2.221 E + 02
10/28/80	801544	CB	1	7.400 E + 00	1.500 E + 02	1.000 E + 00	100	Metal	100	1.000 E - 04	1.000 E - 03	3.134 E + 02
10/28/80	801545	CB	1	7.400 E + 00	1.500 E + 02	1.000 E + 00	100	Metal	100	1.000 E - 04	1.000 E - 03	5.013 E + 02
10/28/80	801546	CB	1	7.400 E + 00	1.500 E + 02	1.000 E + 00	100	Metal	100	1.000 E - 04	1.000 E - 03	3.972 E + 02
10/28/80	801547	CB	1	7.400 E + 00	1.500 E + 02	1.000 E + 00	100	Metal	100	1.000 E - 04	1.000 E - 03	5.122 E + 02
10/28/80	801548	CB	1	7.400 E + 00	1.500 E + 02	1.000 E + 00	100	Metal	100	1.000 E - 04	1.000 E - 03	5.143 E + 02
10/28/80	801549	CB	1	7.400 E + 00	1.500 E + 02	1.000 E + 00	100	Metal	100	1.000 E - 04	1.000 E - 03	5.117 E + 02
10/28/80	801550	CB	1	7.400 E + 00	1.500 E + 02	1.000 E + 00	100	Metal	100	1.000 E - 04	1.000 E - 03	4.948 E + 02
10/28/80	801551	CB	1	7.400 E + 00	1.500 E + 02	1.000 E + 00	100	Metal	100	1.000 E - 04	1.000 E - 03	4.839 E + 02
10/28/80	801552	CB	1	7.400 E + 00	1.500 E + 02	1.000 E + 00	100	Metal	100	1.000 E - 04	1.000 E - 03	2.517 E + 02
Total	--	--	12	8.880 E + 01	1.800 E + 03	--	--	--	--	1.200 E - 03	1.200 E - 02	5.230 E + 03

NOTE: Stored in 55-gal drums in burial ground 4C, trench T01, no known hazardous constituents present.

NOTE: The information in this table should be considered suspect due to the uniformity of the twelve drums' reactivities, weights, Pu contents and MFP contents.

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Table 4-24. Isotopic Distribution for Transuranic Waste Time Table.
(Sheet 1 of 3)

Years	Isotope	Gram quantity	Grams to curies quantity	Curie quantity
1970 to 1973	²⁴¹ Am	1.001 E - 02	3.435 E - 02	--
	¹⁴¹ Ce	--	--	1.000 E - 03
	Mixed fission products (MFP)	--	--	1.134 E + 03
	²³⁷ Np	1.397 E + 02	9.849 E - 01	--
	Pu	1.599 E + 04	1.335 E + 03	--
	²³⁸ Pu	1.902 E + 00	3.256 E + 01	--
	Th	5.607 E + 04	6.151 E - 02	--
	U-D	4.756 E + 05	1.599 E + 00	--
	U-E	1.057 E + 05	2.285 E + 00	--
	U-N	9.364 E + 05	6.442 E - 01	--
	²³³ U	9.650 E + 01	9.302 E + 00	--
	Subtotal	1.590 E + 06	1.383 E + 03	1.134 E + 03
1974 to 1977	²⁴¹ Am	6.000 E - 01	2.060 E + 00	--
	¹⁴⁴ Ce, ¹⁴⁴ Pr	--	--	5.298 E + 04
	⁶⁰ Co	--	--	2.232 E + 03
	¹³⁷ Cs, ¹³⁷ Ba	--	--	1.679 E + 04
	¹⁵⁵ Eu	--	--	3.810 E + 01
	⁸⁵ Kr	--	--	3.730 E + 03
	MFP	--	--	2.387 E + 05
	²³⁷ Np	7.300 E + 01	5.146 E - 01	--
	¹⁴⁷ Pm	--	--	4.023 E + 04
	Pu	5.213 E + 04	4.353 E + 03	--
	²³⁸ Pu	3.000 E - 01	5.136 E + 00	--
	¹⁰⁶ Ru, ¹⁰⁶ Rh	--	--	5.254 E + 03
	⁹⁰ Sr, ⁹⁰ Y	--	--	1.654 E + 04
	Th	5.047 E + 05	5.537 E - 01	--
	U-D	7.445 E + 06	2.503 E + 01	--
	U-E	4.069 E + 04	8.798 E - 01	--
	U-N	4.503 E + 04	3.098 E - 02	--
	²³³ U	7.437 E + 03	7.169 E + 02	--

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Table 4-24. Isotopic Distribution for Transuranic Waste Time Table.
(Sheet 2 of 3)

Years	Isotope	Gram quantity	Grams to curies quantity	Curie quantity
	Subtotal	8.095 E + 06	5.104 E + 03	3.765 E + 05
1978 to 1981	²⁴¹ Am	5.247 E + 01	1.801 E + 02	--
	¹⁴ C	--	--	1.600 E + 00
	¹⁴⁴ Ce, ¹⁴⁴ Pr	--	--	3.750 E + 01
	²⁴⁵ Cm	2.000 E + 00	3.138 E - 01	--
	³ H	--	--	6.803 E + 00
	MFP	--	--	4.148 E + 05
	Pu	2.332 E + 05	1.947 E + 04	--
	²³⁸ Pu	5.238 E + 03	8.967 E + 04	--
	¹⁰⁶ Ru, ¹⁰⁶ Rh	--	--	3.750 E + 01
	Th	1.026 E + 04	1.125 E - 02	--
	U-D	5.203 E + 06	1.749 E + 01	--
	U-E	1.922 E + 04	4.155 E - 01	--
	U-N	2.169 E + 06	1.492 E + 01	--
	²³³ U	1.224 E + 01	1.180 E + 00	--
	Subtotal	7.640 E + 06	1.093 E + 05	4.149 E + 05
1982 to 1985	²⁴¹ Am	1.223 E + 02	4.199 E + 02	--
	²⁴³ Am	5.259 E + 01	9.729 E + 00	--
	²⁵² Cf	2.000 E + 00	1.290 E + 03	--
	²⁴⁵ Cf	4.622 E + 01	7.252 E + 00	--
	¹³⁷ Cs, ¹³⁷ Ba	--	--	1.700 E - 02
	Li	5.900 E + 00	5.900 E + 00	--
	MFP	--	--	8.784 E + 04
	²³⁷ Np	1.388 E + 02	9.784 E - 01	--
	Pu	1.057 E + 05	8.825 E + 03	--
	²³⁸ Pu	2.390 E + 00	4.092 E + 01	--
	Th	1.825 E + 04	2.002 E - 02	--
	U-D	1.357 E + 06	4.562 E + 00	--
	U-E	1.515 E + 05	3.275 E + 00	--
	U-N	8.029 E + 05	5.524 E - 01	--

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Table 4-24. Isotopic Distribution for Transuranic Waste Time Table.
(Sheet 3 of 3)

Years	Isotope	Gram quantity	Grams to curies quantity	Curie quantity
	²³³ U	2.997 E + 02	2.889 E + 01	--
	Subtotal	2.436 E + 06	1.064 E + 04	8.784 E + 04
1986 to 1988	²⁴¹ Am	8.230 E + 00	2.825 E + 01	--
	²⁴³ Am	1.700 E - 01	3.145 E - 02	--
	MFP	--	--	1.401 E + 05
	²³⁷ Np	2.200 E + 02	1.551 E - 02	--
	Pu	6.392 E + 04	5.336 E + 03	--
	²³⁸ Pu	3.680 E + 00	6.300 E + 01	--
	Th	2.581 E + 04	2.831 E - 02	--
	U-D	2.399 E + 04	8.066 E - 02	--
	U-E	3.972 E + 04	8.588 E + 00	--
	U-N	1.256 E + 04	8.643 E - 03	--
	²³³ U	4.480 E + 02	4.318 E + 01	--
	Subtotal	1.665 E + 05	5.472 E + 03	1.401 E + 05
	Grand total	1.993 E + 07	1.319 E + 05	1.021 E + 06

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Table 4-25. Isotopic Distribution for Transuranic (TRU) Waste by Generator from 1970 to December 31, 1988.
(Sheet 1 of 8)

Waste generator	Isotope	Gram quantity	Grams to curies quantity	Curie quantity
Babcock Wilcox, Appolla, PA	²⁴¹ Am	8.088 E + 01	2.776 E + 02	--
	Mixed fission products (MFP)	--	--	5.460 E + 01
	Pu	1.452 E + 04	1.212 E + 03	--
	U-D	4.154 E + 04	1.396 E - 01	--
	U-N	2.946 E + 03	2.027 E - 03	--
Subtotal		5.908 E + 04	1.490 E + 03	5.460 E + 01
University of California, Lawrence Berkely Laboratories	²⁴⁵ Cm	4.000 E + 01	6.276 E + 00	--
	MFP	--	--	4.010 E + 01
	Pu	1.000 E + 00	8.350 E - 02	--
Subtotal		4.100 E + 01	6.359 E + 00	4.010 E + 01
Bartleville Energy Technology Center, OK	²⁴¹ Am	1.500 E - 01	5.151 E - 01	--
	¹⁴ C	--	--	1.600 E + 00
	³ H	--	--	6.803 E + 00
	MFP	--	--	8.471 E + 00
	Pu	3.000 E - 04	2.505 E - 05	--
Subtotal		1.503 E - 01	5.151 E - 01	1.687 E + 01

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Table 4-25. Isotopic Distribution for Transuranic (TRU) Waste by Generator from 1970 to December 31, 1988.
(Sheet 2 of 8)

Waste generator	Isotope	Gram quantity	Grams to curies quantity	Curie quantity
Energy Systems Group, Canoga Park	²⁴¹ Am	2.207 E + 00	7.577 E + 00	--
	¹³⁷ Cs, ¹³⁷ Ba	--	--	1.700 E -02
	MFP	--	--	2.862 E + 01
	²³⁷ Np	1.000 E - 04	7.049 E - 07	--
	Pu	7.249 E + 02	6.053 E + 01	--
	U-D	3.670 E + 01	1.234 E - 04	--
	U-E	2.348 E + 03	5.077 E - 02	--
Subtotal		3.112 E + 03	6.816 E + 01	2.863 E + 01
Dow Chemical (Rocky Flats), Golden, CO	MFP	--	--	5.109 E + 01
	Pu	1.001 E + 02	8.360 E + 00	--
	U-D	3.422 E + 06	1.150 E + 01	--
Subtotal		3.422 E + 06	1.986 E + 01	5.109 E + 01
Exxon Nuclear Systems, Richland, WA	MFP	--	--	9.915 E + 00
	Pu	3.573 E + 04	2.983 E + 03	--
	U-N	1.069 E + 06	7.353 E - 01	--
Subtotal		1.104 E + 06	2.984 E + 03	9.915 E + 00

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Table 4-25. Isotopic Distribution for Transuranic (TRU) Waste by Generator from 1970 to December 31, 1988.
(Sheet 3 of 8)

Waste generator	Isotope	Gram quantity	Grams to curies quantity	Curie quantity
General Electric (GE), Vallecitos, CA	^{144}Ce , ^{144}Pr	--	--	$5.298 \text{ E} + 04$
	^{60}Co	--	--	$2.232 \text{ E} + 03$
	^{137}Cs , ^{137}Ba	--	--	$1.679 \text{ E} + 04$
	^{155}Eu	--	--	$3.810 \text{ E} + 01$
	^{85}Kr	--	--	$3.730 \text{ E} + 03$
	MFP	--	--	$2.971 \text{ E} + 05$
	^{147}Pm	--	--	$4.023 \text{ E} + 04$
	Pu	$5.801 \text{ E} + 03$	$4.844 \text{ E} + 02$	--
	^{106}Ru , ^{106}Rh	--	--	$5.254 \text{ E} + 03$
	^{90}Sr , ^{90}Y	--	--	$1.654 \text{ E} + 04$
	U-D	$1.811 \text{ E} + 04$	$6.089 \text{ E} - 02$	--
	U-E	$8.413 \text{ E} + 04$	$1.819 \text{ E} + 00$	--
	U-N	$1.612 \text{ E} + 05$	$1.109 \text{ E} - 01$	--
Subtotal		$2.692 \text{ E} + 05$	$4.864 \text{ E} + 02$	$4.349 \text{ E} + 05$
GE, San Jose, CA	Pu	$6.344 \text{ E} + 02$	$5.297 \text{ E} + 01$	--
	U-E	$1.099 \text{ E} + 03$	$2.376 \text{ E} - 02$	--

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Table 4-25. Isotopic Distribution for Transuranic (TRU) Waste by Generator from 1970 to December 31, 1988.
(Sheet 4 of 8)

Waste generator	Isotope	Gram quantity	Grams to curies quantity	Curie quantity
GE, San Jose, CA (cont.)	U-N	8.508 E + 02	5.854 E - 04	--
Subtotal		2.584 E + 03	5.300 E + 01	--
Argonne National Laboratories, Argonne, IL	MFP	--	--	3.390 E + 04
	Pu	2.200 E + 02	1.837 E + 01	--
	Th	3.716 E + 04	4.076 E - 02	--
	U-E	4.916 E + 03	1.063 E - 01	--
	²³³ U	7.113 E + 02	6.856 E + 01	--
Subtotal		4.301 E + 04	8.708 E + 01	3.390E + 04
J. A. Jones, Richland, WA	MFP	--	--	4.177 E + 01
	Pu	4.447 E + 02	3.713 E + 01	--
	U-N	3.027 E + 00	2.083 E - 06	--
Subtotal		4.478 E + 02	3.713 E + 01	4.177 E + 01
Kerr McGee, Crescent, OK	²⁴¹ Am	4.369 E + 01	1.500 E + 02	--
	MFP	--	--	6.001 E + 01
	Pu	9.230 E + 03	7.707 E + 02	--
	U-N	2.118 E + 04	1.457 E - 02	--
Subtotal		3.045 E + 04	9.207 E + 02	6.001 E + 01
Lawrence Livermore Laboratories	MFP	--	--	7.500 E - 03

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Table 4-25. Isotopic Distribution for Transuranic (TRU) Waste by Generator from 1970 to December 31, 1988.
(Sheet 5 of 8)

Waste generator	Isotope	Gram quantity	Grams to curies quantity	Curie quantity
Lawrence Livermore Laboratories (cont.)	Pu	7.000 E + 00	5.845 E - 01	--
	U-D	2.000 E + 03	6.724 E - 03	--
Subtotal		2.007 E + 03	5.912 E - 01	7.500 E - 03
Ceer University, Mayaguez, Puerto Rico	MFP	--	--	5.000E - 02
Subtotal		--	--	5.000E - 02
Battelle, Columbus, OH	MFP	--	--	7.398 E + 00
	Pu	2.125 E + 02	1.774 E + 01	--
	²³⁸ Pu	7.130 E + 00	1.221 E + 02	--
	U-D	1.005 E + 03	3.379 E - 03	--
	U-E	4.155 E + 02	8.983 E - 03	--
	U-N	8.000 E + 03	5.504 E - 03	--
Subtotal		9.640 E + 03	1.398 E + 02	7.398 E + 00
Pacific Northwest Laboratories, Richland, WA	²⁴¹ Am	3.254 E + 01	1.117 E + 02	--
	²⁴³ Am	4.600 E - 01	8.510 E - 02	--
	²⁴⁵ Cm	6.220 E + 00	9.759 E - 01	--
	MFP	--	--	3.810 E + 05
	²³⁷ Np	9.000 E + 01	6.344 E - 01	--
	Pu	1.422 E + 04	1.187 E + 03	--
	²³⁸ Pu	6.372 E + 00	1.091 E + 02	--
	Th	5.297 E + 05	5.811 E - 01	--

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Table 4-25. Isotopic Distribution for Transuranic (TRU) Waste by Generator from 1970 to December 31, 1988.
(Sheet 6 of 8)

Waste generator	Isotope	Gram quantity	Grams to curies quantity	Curie quantity
Pacific Northwest Laboratories, Richland, WA (cont.)	U-D	5.874 E + 05	1.975 E + 00	--
	U-E	1.885 E + 04	4.074 E - 01	--
	U-N	4.085 E + 05	2.811 E - 01	--
	²³³ U	7.296 E + 03	7.033 E + 02	--
Subtotal		1.565 E + 06	2.116 E + 03	3.810 E + 05
Rockwell International (Rocky Flats), Golden, CO	²⁴¹ Am	2.302 E + 01	7.561 E + 01	--
	MFP	--	--	3.421 E + 01
	Pu	2.069 E + 03	1.728 E + 02	--
	U-D	9.579 E + 06	3.220 E + 01	--
	U-E	1.037 E + 03	2.242 E - 02	--
	U-N	5.301 E + 04	3.647 E - 02	--
Subtotal		9.635 E + 06	2.806 E + 02	3.421 E + 01
IAEA, Seibersdorf, Austria	MFP	--	--	5.000 E - 02

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Table 4-25. Isotopic Distribution for Transuranic (TRU) Waste by Generator from 1970 to December 31, 1988.
(Sheet 7 of 8)

Waste generator	Isotope	Gram quantity	Grams to curies quantity	Curie quantity
IAEA, Seibersdorf, Austria (cont.)	Pu	1.940 E + 01	1.620 E + 00	--
Subtotal		1.940 E + 01	1.620 E + 00	5.000 E - 02
Ward, Cheswick, PA	MFP	--	--	8.637 E + 01
	Pu	3.140 E + 03	2.622 E + 02	--
	Th	1.000 E + 03	1.097 E - 03	--
	U-D	1.267 E + 04	4.260 E - 02	--
	U-E	3.117 E + 03	6.738 E - 02	--
	U-N	3.561 E + 04	2.450 E - 02	--
Subtotal		5.554 E + 04	2.623 E + 02	8.637 E + 01
Westinghouse Hanford	²⁴¹ Am	2.149 E + 00	7.378 E + 00	--
	²⁴³ Am	5.230 E + 01	9.676 E + 00	--
	¹⁴¹ Ce	--	--	1.000 E - 03
	¹⁴⁴ Ce, ¹⁴⁴ Pr	--	--	3.750 E + 01
	²⁵² Cf	2.000 E + 00	1.290 E + 03	--
	²⁴⁵ Cm	2.000 E + 00	3.138 E - 01	--
	Li	5.900 E + 00	5.900 E + 00	--
	MFP	--	--	1.704 E + 05

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Table 4-25. Isotopic Distribution for Transuranic (TRU) Waste by Generator from 1970 to December 31, 1988.
(Sheet 8 of 8)

Waste generator	Isotope	Gram quantity	Grams to curies quantity	Curie quantity
Westinghouse Hanford (cont.)	^{237}Np	2.637 E + 02	1.859 E + 00	--
	Pu	3.839 E + 05	3.205 E + 04	--
	^{238}Pu	5.233 E + 03	8.958 E + 04	--
	^{106}Ru , ^{106}Rh	--	--	3.750E + 01
	Th	4.723 E + 04	5.181 E - 02	--
	U-D	8.406 E + 05	2.826 E + 00	--
	U-E	2.409 E + 05	5.208 E + 00	--
	U-N	2.206 E + 06	1.518 E + 00	--
	^{233}U	2.862 E + 02	2.759 E + 01	--
Subtotal		3.725 E + 06	1.230 E + 05	1.704 E + 05
Grand Total for all companies		1.993 E + 07	1.319 E + 05	1.021 E + 06

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Table 4-26. Transuranic (TRU) Grams per 55-gal Drum Distribution for Transuranic Waste (January 1, 1970 to December 31, 1988).

TRU grams range	1970 to 1977 number of containers	1978 to 1981 number of containers	1982 to 1985 number of containers	1986 to 1988 number of containers	Total number of containers
<0.080	10,413	4,293	2,907	187	17,800
0.080 to <0.100	2	1	1	4	8
0.100 to <001	1,129	275	413	147	1,964
001 to <010	5,153	1,520	3,774	1,033	11,480
010 to <020	446	1,008	636	173	2,263
020 to <030	237	198	122	82	639
030 to <050	273	383	141	108	905
050 to <075	121	341	102	89	653
075 to <100	72	266	84	81	503
100 to <125	20	168	68	78	334
125 to <150	5	119	70	63	257
150 to <175	5	218	46	46	315
175 to <200	38	350	69	17	474
200 to <225	3	10	17	1	31
225 to <250	1	2	0	0	3
250 to <300	0	1	0	0	1
300 to <400	0	2	0	1	3
400 to <500	0	2	0	0	2
500 to <550	0	6	0	0	6
Totals	17,918	9,163	8,450	2,110	37,641

NOTE: The total number of drums is 37,641. The average gram per drum is $1.124 \text{ E} + 01$. The total Pu grams are $4.229 \text{ E} + 05$.

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Table 4-27. Transuranic (TRU) Grams and Weight Data by Metal Box Size. (Sheet 1 of 3)

Container code and container description	Total number of containers	Total TRU (g)	Total alpha (Ci)	Total container weight (lb)	Total container volume (ft ³)	Average density (lb/ft ³)
DU = Glove boxes, miscellaneous sizes	16	8.209 E+02	6.855 E+01	6.009 E+04	2.146 E+03	2.800 E+01
DV = Bins, 4 x 5 x 6	72	4.439 E+02	1.605 E+01	2.396 E+05	1.213 E+04	1.975 E+01
DZ = Metal boxes, miscellaneous sizes	49	8.202 E+03	6.849 E+02	2.662 E+05	1.242 E+04	2.143 E+01
TE = Metal box, 4 x 6 x 15	2	2.000 E+02	1.670 E+01	2.016 E+04	7.200 E+02	2.800 E+01
TF = Metal box, 4 x 4 x 7	8	1.402 E+03	1.171 E+02	2.315 E+04	8.748 E+02	2.646 E+01
Tg = Metal box, 5 x 6 x 11	1	2.502 E+02	2.089 E+01	6.865 E+03	3.390 E+02	2.025 E+01
TH = Metal box, 4.17 x 6.25 x 15.56	1	1.000 E-04	8.350 E-06	5.500 E+03	4.060 E+02	1.355 E+01*
TK = Metal box, 5.43 x 7.7 x 11	4	1.450 E+02	1.211 E+01	6.000 E+04	1.840 E+03	3.261 E+01
TL = Metal box, 6 x 7.1 x 12	3	2.450 E+02	2.046 E+01	3.600 E+04	1.519 E+03	2.370 E+01
TM = Metal box, 6 x 6 x 7	32	1.693 E+03	1.414 E+02	1.828 E+05	7.434 E+03	2.459 E+01
TN = Metal box, 7 x 12 x 16	1	7.200 E+00	6.012 E-01	2.910 E+04	1.346 E+03	2.162 E+01*
TO = Metal box, 5.4 x 5.6 x 6.8	14	8.797 E+02	7.336 E+01	8.412 E+04	2.882 E+03	2.919 E+01
TR = Metal box, 5 x 5 x 9	1	4.878 E+01	4.060 E+00	6.034 E+03	2.200 E+02	2.743 E+01
YA = Metal box, 4.25 x 2.63 x 2.63	3	3.000 E+00	2.505 E-01	2.460 E+03	8.790 E+01	2.799 E+01
YB = Metal box, 4 x 8 x 10	1	5.000 E+00	4.175 E-01	8.960 E+03	3.200 E+02	2.800 E+01
YC = Metal box, 2 x 3 x 15	1	1.000 E+01	8.350 E-01	2.520 E+03	9.000 E+01	2.800 E+01
YD = Metal box, 5.21 x 7.13 x 16.5	4	4.700 E+01	3.925 E+00	6.853 E+04	2.447 E+03	2.801 E+01
YE = Metal box, 4 x 8 x 16	1	1.000 E-04	8.350 E-06	1.434 E+04	5.120 E+02	2.801 E+01*
YF = Metal box, 5.21 x 7.13 x 10.5	9	3.036 E+02	2.535 E+01	1.011 E+05	3.501 E+03	2.888 E+01

Table 4-27. Transuranic (TRU) Grams and Weight Data by Metal Box Size. (Sheet 2 of 3)

Container code and container description	Total number of containers	Total TRU (g)	Total alpha (Ci)	Total container weight (lb)	Total container volume (ft ³)	Average density (lb/ft ³)
YG = Metal box, 6 x 8 x 12	1	5.000 E - 02	4.175 E - 03	1.500 E + 04	5.060 E + 02	2.964 E + 01*
YJ = Metal box, 5 x 5 x 7	7	7.503 E + 02	6.238 E + 01	4.498 E + 04	1.211 E + 03	3.714 E + 01
YK = Metal box, 5 x 10 x 13	1	2.400 E + 02	2.004 E + 01	1.820 E + 04	6.500 E + 02	2.800 E + 01
YL = Metal box, 5 x 5 x 5	1	1.000 E - 01	8.350 E - 03	3.500 E + 03	1.250 E + 02	2.800 E + 01*
YM = Metal box, 7 x 10 x 16	1	1.000 E - 01	8.350 E - 03	3.136 E + 04	1.120 E + 03	2.800 E + 01*
YN = Metal box, 1,250 ft ³	1	1.000 E + 00	8.350 E - 02	3.500 E + 04	1.250 E + 03	2.800 E + 01*
YP = Metal box, 2 x 4 x 8	1	4.940 E + 02	4.125 E + 01	8.680 E + 03	3.100 E + 02	2.800 E + 01
YQ = Metal box, 2 x 2 x 6	1	1.000 E + 00	8.350 E - 02	6.720 E + 02	2.400 E + 01	2.800 E + 01
YT = Metal box, 4 x 4 x 5	2	3.048 E + 00	2.545 E - 01	4.480 E + 03	1.600 E + 02	2.800 E + 01
YU = Metal box, 4 x 5 x 9	1	1.000 E + 00	8.350 E - 02	5.040 E + 03	1.800 E + 02	2.800 E + 01*
YY = Metal box, 4 x 5 x 6	1	1.047 E + 01	8.718 E - 01	7.000 E + 03	1.200 E + 02	5.833 E + 01
ZA = Metal box, 3 x 3 x 4	4	5.022 E + 00	4.194 E - 01	4.032 E + 03	1.440 E + 02	2.800 E + 01
ZB = Metal box, 3 x 5 x 8	2	3.049 E + 00	2.633 E - 01	6.720 E + 03	2.400 E + 02	2.800 E + 01
ZC = Metal box, 5 x 7 x 17	1	1.674 E + 00	1.398 E - 01	1.666 E + 04	5.950 E + 02	2.800 E + 01*
ZD = Metal box, 4 x 6 x 16.5	1	1.000 E - 04	8.350 E - 06	1.109 E + 04	3.960 E + 02	2.801 E + 01*
ZE = Metal box, 4 x 4 x 4	5	8.455 E + 01	7.078 E + 00	8.960 E + 03	3.200 E + 02	2.800 E + 01
ZF = Metal box, 3.5 x 6 x 8	1	5.000 E + 01	4.175 E + 00	4.708 E + 03	1.680 E + 02	2.802 E + 01
ZG = Metal box, 3.17 x 4.5 x 6.67	1	1.000 E + 00	8.350 E - 02	2.660 E + 03	9.500 E + 01	2.800 E + 01
ZH = Metal box, 4.5 x 6 x 10	1	3.487 E + 00	2.542 E - 01	7.560 E + 03	2.700 E + 02	2.800 E + 01
ZI = Metal box, 2 x 2 x 3	18	5.216 E + 00	4.356 E - 01	6.261 E + 03	2.177 E + 02	2.876 E + 01

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Table 4-27. Transuranic (TRU) Grams and Weight Data by Metal Box Size. (Sheet 3 of 3)

Container code and container description	Total number of containers	Total TRU (g)	Total alpha (Ci)	Total container weight (lb)	Total container volume (ft ³)	Average density (lb/ft ³)
ZJ = Metal box, 108 ft ³	1	1.375 E + 00	1.235 E - 01	3.024 E + 03	1.080 E + 02	2.800 E + 01
ZK = Metal box, 4 x 4 x 8	1	1.000 E - 04	8.350 E - 06	3.584 E + 03	1.280 E + 02	2.800 E + 01*
ZL = Metal box, 269 ft ³	2	8.750 E + 00	7.307 E - 01	7.532 E + 03	2.690 E + 02	2.800 E + 01
ZM = Metal box, 149 ft ³	1	8.750 E + 00	7.307 E - 01	4.172 E + 03	1.490 E + 02	2.800 E + 01
ZN = Metal box, 197 ft ³	3	2.088 E + 02	1.743 E + 01	1.103 E + 04	3.940 E + 02	2.799 E + 01
ZO = Metal box, 252 ft ³	6	4.758 E + 01	3.973 E + 00	4.756 E + 04	1.512 E + 03	3.146 E + 01
ZP = Metal box, 2.5 x 2.5 x 4	25	2.500 E - 03	2.088 E - 04	1.750 E + 04	6.250 E + 02	2.800 E + 01*
ZQ = Metal box, 3 x 4 x 7	1	1.000 E - 04	8.350 E - 06	2.352 E + 03	8.400 E + 01	2.800 E + 01*
ZR = Metal box, 4 x 5.5 x 16	1	1.000 E - 04	8.350 E - 06	9.856 E + 03	3.520 E + 02	2.800 E + 01*
ZT = Metal box, 156 ft ³	3	3.001 E + 02	2.506 E + 01	1.315 E + 04	4.695 E + 02	2.801 E + 01
ZU = Metal box, 115 ft ³	1	2.500 E + 01	2.088 E + 00	3.220 E + 03	1.150 E + 02	2.800 E + 01
ZV = Metal box, 80.8 ft ³	1	2.000 E + 01	1.670 E + 00	2.262 E + 03	8.080 E + 01	2.800 E + 01
ZW = Metal box, 3 x 4 x 10	2	1.000 E + 01	8.351 E - 01	3.696 E + 03	2.400 E + 02	1.540 E + 01
ZX = Metal box, 4 x 6 x 10	6	9.170 E + 01	7.657 E + 00	3.955 E + 04	1.456 E + 03	2.716 E + 01
ZY = Metal box, 216 ft ³	2	2.000 E - 03	1.670 E - 04	1.210 E + 04	4.320 E + 02	2.801 E + 01*
Totals	329	1.708 E + 04	1.405 E + 03	1.641 E + 06	6.575 E + 04	2.495 E + 01

*Container(s) probably will be classified as low-level waste in the Waste Receiving and Processing Facility.

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Table 4-28. Transuranic (TRU) Grams and Weight Data by Waste in Fiber Glass-Reinforced Polyester (FRP) Box Size. (Sheet 1 of 2)

Container code and container description	Total number of containers	Total TRU (g)	Total alpha (Ci)	Total container weight (lb)	Total container volume (ft ³)	Average density (lb/ft ³)
FA = FRP, 4 x 4 x 7	35	2.646 E + 02	2.210 E + 01	8.714 E + 04	3.932 E + 03	2.214 E + 01
FB = FRP, 5 x 6 x 16	1	1.000 E + 00	8.350 E - 02	1.344 E + 04	4.800 E + 02	2.800 E + 01 ^a
FC = FRP, 6.5 x 8 x 14.6	9	5.670 E + 02	4.735 E + 01	1.612 E + 05	6.840 E + 03	2.356 E + 01
FD = FRP, 6.5 x 8 x 18.5	3	1.460 E + 02	1.219 E + 01	5.682 E + 04	2.874 E + 03	1.977 E + 01
FH = FRP, 9 x 10.67 x 20	17	1.434 E + 03	1.197 E + 02	8.190 E + 05	3.266 E + 04	2.508 E + 01
FI = FRP, 4.6 x 5.1 x 11.8	1	1.000 E + 00	8.350 E - 02	4.336 E + 03	2.738 E + 02	1.584 E + 01 ^a
FJ = FRP, 9 x 10.67 x 16	23	1.334 E + 03	1.114 E + 02	3.940 E + 05	3.409 E + 04	1.166 E + 01
FK = FRP, 4.83 x 5 x 8	2	2.500 E + 01	2.088 E + 00	1.085 E + 04	3.860 E + 02	2.812 E + 01
FL = FRP, 9 x 11.67 x 20	7	1.741 E + 03	1.454 E + 02	3.316 E + 05	1.387 E + 04	2.391 E + 01
FM = FRP, 9 x 10.67 x 12	17	2.023 E + 03	1.689 E + 02	4.877 E + 05	1.958 E + 04	2.490 E + 01
FN = FRP, 10.5 x 10.67 x 12	5	1.750 E + 02	1.461 E + 01	8.773 E + 04	6.720 E + 03	1.306 E + 01
FO = FRP, 9 x 12 x 12.67	1	1.400 E + 01	1.169 E + 00	8.000 E + 03	1.368 E + 03	5.848 E + 00
FP = FRP, 5.6 x 7.3 x 10.1	16	5.610 E - 01	4.685 E - 02	6.372 E + 04	6.608 E + 03	9.643 E + 00 ^a
FQ = FRP, 6.33 x 8 x 14.67	1	2.530 E + 02	2.113 E + 01	2.128 E + 04	7.600 E + 02	2.800 E + 01
FS = FRP, 8 x 10 x 16	5	2.709 E + 02	2.262 E + 01	1.365 E + 05	6.497 E + 03	2.101 E + 01
FT = FRP, 8 x 8 x 10.7	2	2.200 E + 01	1.837 E + 00	1.525 E + 04	1.390 E + 03	1.097 E + 01
FU = FRP, 9.5 x 9.94 x 12	1	2.000 E + 01	1.670 E + 00	9.750 E + 03	1.133 E + 03	8.605 E + 00
FV = FRP, 9 x 12.67 x 20	7	4.090 E + 02	3.415 E + 01	1.450 E + 05	1.597 E + 04	9.081 E + 00
FW = FRP, 8.25 x 10.58 x 19.58	1	1.080 E + 02	9.019 E + 00	8.300 E + 04	1.700 E + 03	4.882 E + 01
FX = FRP, 5.8 x 5.8 x 9.6	7	3.850 E + 00	3.215 E - 01	2.871 E + 04	2.250 E + 03	1.276 E + 01 ^a

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Table 4-28. Transuranic (TRU) Grams and Weight Data by Waste in Fiber Glass-Reinforced Polyester (FRP) Box Size. (Sheet 2 of 2)

Container code and container description	Total number of containers	Total TRU (g)	Total alpha (Ci)	Total container weight (lb)	Total container volume (ft ³)	Average density (lb/ft ³)
FY = FRP, 5.8 x 5.8 x 10.6	2	1.080 E + 00	9.019 E - 02	8.599 E + 03	7.100 E + 02	1.211 E + 01 ^a
FZ = FRP, 5.3 x 5.7 x 9.8	6	2.900 E - 01	2.422 E - 02	2.387 E + 04	1.783 E + 03	1.338 E + 01 ^a
JA = FRP, 6 x 6.1 x 9.6	1	2.600 E - 01	2.171 E - 02	4.292 E + 03	3.498 E + 02	1.227 E + 01 ^a
JB = FRP, 6 x 6 x 6	7	8.680 E - 01	7.248 E - 02	2.494 E + 04	1.667 E + 03	1.496 E + 01 ^a
JC = FRP, 5.3 x 5.7 x 7.3	3	1.130 E + 00	9.436 E - 02	9.470 E + 03	6.573 E + 02	1.441 E + 01 ^a
JD = FRP, 5.5 x 5.7 x 11.2	3	5.722 E + 01	4.778 E + 00	1.456 E + 04	1.041 E + 03	1.398 E + 01
JE = FRP, 4.7 x 7.8 x 11	11	6.154 E - 01	5.139 E - 02	4.410 E + 04	4.378 E + 03	1.007 E + 01 ^a
JF = FRP, 6.2 x 6.2 x 9	4	1.170 E + 00	9.770 E - 02	1.572 E + 04	1.216 E + 03	1.293 E + 01 ^a
JG = FRP, 5.6 x 7.4 x 11.3	3	1.260 E - 01	1.052 E - 02	1.288 E + 04	1.398 E + 03	9.213 E + 00 ^a
JH = FRP, 3.8 x 4.3 x 12.5	1	3.290 E - 01	2.747 E - 02	4.960 E + 03	2.040 E + 02	2.431 E + 01 ^a
Totals	202	8.876 E + 03	7.412 E + 02	3.128 E + 06	1.728 E + 05	1.753 E + 01

^aContainer(s) probably will be classified as low-level waste in the Waste Receiving and Processing Facility.

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Table 4-29. Grams and Weight Data by Concrete Box Size.

Container code and container description	Total number of containers	Total TRU (g)	Total alpha (Ci)	Total container weight (lb)	Total container volume (ft ³)	Average density (lb/ft ³)
CH = Concrete box/blocks, miscellaneous sizes	1	2.000 E + 01	1.670 E + 00	4.550 E + 04	1.625 E + 03	2.800 E + 01
GA = Concrete, 5.46 x 5.46 x 6.29	18 ^b	4.456 E + 03	3.721 E + 02	4.860 E + 05	3.384 E + 03	1.436 E + 02
GB = Concrete, 121 ft ³	4 ^b	2.474 E + 02	2.066 E + 01	7.200 E + 04	4.840 E + 02	1.488 E + 02
GC = Concrete, 4 x 4 x 8	1	1.000 E + 00	8.350 E - 02	8.320 E + 03	1.280 E + 02	6.500 E + 01 ^a
GD = Concrete, 4 x 7 x 9	2	3.000 E + 00	2.505 E - 01	3.276 E + 04	5.040 E + 02	6.500 E + 01 ^a
GL = Concrete, 3 x 3 x 3	24	8.101 E + 00	6.765 E - 01	4.601 E + 04	6.269 E + 02	7.409 E + 01 ^a
GM = Concrete, 4 x 4 x 4	3	1.200 E + 00	1.002 E - 01	9.480 E + 03	1.920 E + 02	4.938 E + 01 ^a
IV = Concrete, 2.5 x 2.5 x 2.5	5	5.000 E - 04	4.175 E - 05	5.840 E + 03	8.000 E + 01	7.300 E + 01 ^a
Totals	58	4.737 E + 03	3.956 E + 02	7.059 E + 05	7.024 E + 03	1.005 E + 02

^aContainer(s) probably will be classified as low-level waste in the Waste Receiving and Processing Facility. PST89-3122-4-29

^bContains research reactor fuel waste.

Table 4-30. Transuranic (TRU) Grams and Weight Data by Plywood Box Size.

Container code and container description	Total number of containers	Total TRU (g)	Total alpha (Ci)	Total container weight (lb)	Total container volume (ft ³)	Average density (lb/ft ³)
RC = Wood box, 3.17 x 5 x 10.3	1	1.000 E + 00	8.350 E - 02	4.400 E + 03	1.640 E + 02	2.683 E + 01 ^a
VA = Wood box, 5.08 x 6.75 x 6.92	1	1.000 E + 00	8.350 E - 02	8.532 E + 03	2.370 E + 02	3.600 E + 01 ^a
VB = Wood box, 5.25 x 15.25 x 9.33	1	1.000 E + 01	8.350 E - 01	2.686 E + 04	7.460 E + 02	3.600 E + 01
VC = Wood box, 7.83 x 16.83 x 15.5	1	1.000 E + 01	8.350 E - 01	5.544 E + 04	1.540 E + 03	3.600 E + 01 ^a
VD = Wood box, 5.25 x 10.75 x 9.17	1	1.000 E - 04	8.350 E - 06	1.865 E + 04	5.180 E + 02	3.600 E + 01 ^a
WH = Wood box, 4 x 4 x 5	3	4.870 E - 01	4.067 E - 02	6.720 E + 03	2.400 E + 02	2.800 E + 01 ^a
WS = Wood box, 5.75 x 9.67 x 10.83	1	4.000 E + 00	1.765 E + 01	2.171 E + 04	6.030 E + 02	3.600 E + 01
WT = Wood box, 4.08 x 8.83 x 12.75	1	1.400 E + 00	1.169 E - 01	1.926 E + 04	5.350 E + 02	3.600 E + 01 ^a
WU = Wood box, 4.08 x 4.75 x 12.08	1	1.400 E + 00	1.169 E - 01	8.424 E + 03	2.340 E + 02	3.600 E + 01 ^a
WV = Wood box, 4.75 x 4.75 x 5.75	1	1.400 E + 00	1.169 E - 01	4.680 E + 03	1.300 E + 02	3.600 E + 01
WW = Wood box, 4.08 x 4.58 x 12.08	1	1.400 E + 00	1.169 E - 01	8.136 E + 03	2.260 E + 02	3.600 E + 01 ^a
WX = Wood box, 5.75 x 8.08 x 10.75	1	1.000 E + 00	8.350 E - 02	1.800 E + 04	5.000 E + 02	3.600 E + 01 ^a
WY = Wood box, 5.33 x 9.75 x 16.08	1	3.000 E + 00	2.505 E - 01	3.010 E + 04	8.360 E + 02	3.600 E + 01 ^a
WZ = Wood box, 5.42 x 11.33 x 17.75	1	5.000 E + 00	4.175 E - 01	3.924 E + 04	1.090 E + 03	3.600 E + 01 ^a
XA = Wood box, 4 x 4 x 8	3	4.200 E + 00	3.507 E - 01	1.642 E + 04	4.560 E + 02	3.600 E + 01 ^a
XT = Wood box, 4 x 5 x 6	1	2.048 E + 00	1.710 E - 01	2.240 E + 04	8.000 E + 02	2.800 E + 01 ^a
XW = Wood box, 4 x 4 x 4	17	6.109 E + 00	5.101 E - 01	2.724 E + 04	1.088 E + 03	2.504 E + 01 ^a
Totals	37	5.344 E + 01	2.178 E + 01	3.362 E + 05	9.943 E + 03	3.381 E + 01

^aContainer(s) probably will be classified as low-level waste in the Waste Receiving and Processing Facility.

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Table 4-30A. Transuranic (TRU) Gram and Weight Data for Other Container Types.

Container code and container description	Total number of containers	Total TRU (g)	Total alpha (Ci)	Total container weight (lb)	Total container volume (ft ³)	Average density (lb/ft ³)
CA = Hanford standard carton	25	3.213 E - 01	2.683 E - 02	7.000 E + 02	1.125 E + 02	6.222 E + 00
CC = Plastic bags/tubes	1	1.090 E + 00	9.102 E - 02	2.520 E + 02	9.000 E + 00	2.800 E + 01
CI = L-10 Container	83	8.174 E + 03	6.826 E + 02	3.195 E + 04	1.228 E + 03	2.601 E + 01
CK = Truckload - miscellaneous	1	2.150 E - 01	1.795 E - 02	6.440 E + 02	2.300 E + 01	2.800 E + 01
CN = Pipe - plastic or metal	4	8.270 E + 00	6.906 E - 01	2.470 E + 02	9.401 E + 00	2.778 E + 01
CO = 3 L Container	10	9.770 E + 02	8.158 E + 01	4.674 E + 03	4.500 E + 01	1.039 E + 02
CQ = Small box 2 ft ³	1	1.000 E - 04	8.350 E - 06	1.200 E + 01	2.200 E + 00	3.381 E + 01 ^a
CV = Vent pipes	7	5.600 E - 03	4.676 E - 04	1.486 E + 03	9.240 E + 01	2.403 E + 01 ^a
CW = Metal scrap	5	5.450 E + 00	4.551 E - 01	1.700 E + 02	6.000 E + 00	2.833 E + 01
DA = HEPA filters	27	2.916 E + 01	2.435 E + 00	2.362 E + 04	8.524 E + 02	2.686 E + 01
DC = Compressors/casks	24	1.565 E + 02	8.704 E + 00	1.483 E + 05	2.627 E + 03	2.177 E + 02
DF = Metal containers (30 gal)	99	2.174 E + 02	1.799 E + 01	1.036 E + 04	4.081 E + 02	2.501 E + 01
DH = Tanks - decontaminated/cylinder	9	8.690 E + 00	7.257 E - 01	1.877 E + 04	9.256 E + 02	2.664 E + 01
DI = Ion exchange column - UNC	1	1.400 E + 00	1.169 E - 01	8.000 E + 03	7.700 E + 01	1.039 E + 02
DJ = Pump	1	1.090 E + 00	9.102 E - 02	2.800 E + 01	1.000 E + 00	2.800 E + 01
DL = Lard cans (5 gal)	4	4.000 E - 04	3.340 E - 05	2.000 E + 02	2.000 E + 00	1.000 E + 02 ^a
DP = PR cans	78	2.200 E + 01	1.837 E + 00	2.141 E + 04	4.569 E + 02	4.749 E + 01
EB = Equipment	8	4.004 E - 01	3.344 E - 02	3.384 E + 04	1.211 E + 03	2.705 E + 01 ^a
ED = Large cardboard box	1	2.150 E - 01	1.795 E - 02	1.008 E + 03	3.600 E + 01	2.800 E + 01 ^a
EI = Iron drum, 3 x 3 x 4	4	4.000 E - 04	3.340 E - 05	4.032 E + 03	1.440 E + 02	2.800 E + 01 ^a
EL = Concrete culvert, 7 dia. x 12	1	1.000 E - 04	8.350 E - 06	1.294 E + 04	4.620 E + 02	2.800 E + 01 ^a
EN = EBR II cask	15 ^b	1.401 E + 04	1.170 E + 03	7.995 E + 04	3.681 E + 02	2.172 E + 02
EP = Pallets	1	N/A	N/A	2.500 E + 02	5.000 E + 00	5.000 E + 01
HB = 100 gal	51	7.870 E + 03	5.435 E + 02	1.775 E + 04	7.474 E + 02	2.391 E + 01
TS = Metal tank, 4 dia. x 4	1	1.600 E - 02	1.336 E - 03	3.380 E + 03	7.200 E + 01	4.694 E + 01 ^a
Totals	462	3.148 E + 04	2.510 E + 03	4.240 E + 05	9.923 E + 03	1.302 E + 03

NOTE: The information contained in this table should be considered suspect. An evaluation of its data revealed a multitude of conflicting errors, none of which could be accurately traced at the time of this revision.

^aContainer(s) probably will be classified as low-level waste in the Waste Receiving and Processing Facility.

^bContains research reactor fuel waste.

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Table 4-31. Mixed Waste (MW) Distribution
 (January 1, 1970 to December 31, 1988).
 (Sheet 1 of 2)

Container code and description	Total containers with MW	Total containers without MW	Total containers	Hazardous material
CA = Hanford standard carton	0	25	25	
CC = Plastic bags/tubes	0	1	1	
CI = L-10 container	0	83	83	
CK = Truckload, miscellaneous	0	1	1	
CN = Pipe	0	4	4	
CO = 3-L container	10	0	10	Beryllium
Concrete boxes	0	58	58	
CQ = Small box, 2 ft ³	0	1	1	
CV = Vent pipes	0	7	7	
CW = Metal scrap	0	5	5	
DA = High-efficiency particulate air (HEPA) filters	0	27	27	
DC = Compressors/casks	12	12	24	Beryllium Cadmium Lead Lead shielding Zirconium
DF = Metal container, 30 gal	0	99	99	
DH = Tanks-decon cylinder	0	9	9	
DI = Ion-exchange column-UNC	0	1	1	
DJ = Pump	0	1	1	
DL = Lard cans, 5 gal	0	4	4	
DP = PR cans	0	78	78	
EB = Equipment	0	8	8	
ED = Large cardboard box	0	1	1	
EI = Iron drum, 3 x 3 x 4	0	4	4	
EL = Concrete culvert, 7 dia. x 12	0	1	1	
EN = EBR II cask	13	2	15	Lead Lead shielding
EP = Pallets	0	1	1	
Fiber glass-reinforced polyester (FRP) boxes	0	202	202	

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Table 4-31. Mixed Waste (MW) Distribution
 (January 1, 1970 to December 31, 1988).
 (Sheet 2 of 2)

Container code and description	Total containers with MW	Total containers without MW	Total containers	Hazardous material
HB = 110 gal	0	51	51	
Metal boxes	12	317	329	Asbestos Lead Oil Organic
Plywood boxes	0	37	37	
TS = Metal tank, 4 dia. x 4	0	1	1	
55-gal drum	786	36,855	37,641	Antifreeze Asbestos Beryllium Caustic Copper Corrosive Hydraulic fluid Lead Lead shielding Methylene chloride Nitric acid Oil Organic PCB PCB, oil Sodium Sodium hydroxide Solvents: Stripcoat Trichloro-ethene
	833	37,896	38,729	

^aIncludes 12 PFP drums.

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Table 4-32. Mixed Waste (MW) Distribution
(January 1, 1986 to December 31, 1988).

Container code and description	Total containers with MW	Total containers without MW	Total containers	Hazardous material
DC = Compressors/casks	2	0	2	Beryllium Cadmium Lead Lead shielding
EN = EBR II cask	5	0	5	Lead Lead shielding
Metal boxes	0	6	6	
55-gal drum	261	1,849	2,110	Asbestos Beryllium Caustic Copper Hydraulic fluid Lead Lead shielding Methylene chloride Nitric acid Oil PCB Sodium hydroxide Stripcoat Trichloro-ethene
	268	1,855	2,123	

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Table 4-33. Mixed Waste (MW) Distribution
(January 1, 1982 to December 31, 1985).

Container code and description	Total containers with MW	Total containers without MW	Total containers	Hazardous material
CI = L-10 container	0	7	7	
CN = Pipe--plastic or metal	0	1	1	
CO = 3-L container	3	0	3	Beryllium
DC = Compressors/casks	0	1	1	
DF = Metal container, 30 gal	0	4	4	
DP = PR cans	0	78	78	
EN = EBR II cask	6	1	7	Lead
EP = Pallets	0	1	1	
Fiber glass-reinforced polyester (FRP) boxes	0	40	40	
HB = 110 gal	0	15	15	
Metal boxes	9	145	154	Asbestos Lead Oil Organic
TS = Metal tank, 4 dia. x 4	0	1	1	
55-gal drum	344	8,106	8,450	Asbestos Beryllium Copper Corrosive Lead Nitric acid Oil Organic PCB PCB, Oil Sodium
	362	8,400	8,762	

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Table 4-34. Mixed Waste (MW) Distribution
(January 1, 1978 to December 31, 1981).

Container code and description	Total containers with MW	Total containers without MW	Total containers	Hazardous material
CC = Plastic bags	0	1	1	
CI = L-10 container	0	76	76	
CN = Pipe	0	3	3	
CO = 3-L container	7	0	7	Be
Concrete boxes	0	9	9	
CW = Metal scrap	0	5	5	
DC = Compressors/casks	10	0	10	Pb Zr
DH = Tanks-decon cylinder	0	1	1	
DI = Ion-exchange column	0	1	1	
DJ = Pump	0	1	1	
EN = EBR II cask	2	1	3	Lead
Fiber glass-reinforced polyester (FRP) boxes	0	92	92	
Metal boxes	1	42	43	
Plywood boxes	0	1	1	
55-gal drum	163	9,000	9,163	Antifreeze Be Cu Pb Oil Organic Solvents
	183	9,233	9,416	

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Table 4-35. Mixed Waste (MW) Distribution
(January 1, 1974 to December 31, 1977).

Container code and description	Total containers with MW	Total containers without MW	Total containers	Hazardous material
CA = Hanford standard carton	0	2	2	
CK = Truckload, miscellaneous	0	1	1	
Concrete boxes	0	27	27	
DA = High-efficiency particulate air (HEPA) filters	0	14	14	
DC = Compressors/casks	0	11	11	
DF = Metal container, 30 gal	0	2	2	
DH = Tanks-decon cylinder	0	7	7	
DL = Lard cans, 5 gal	0	4	4	
EB = Equipment	0	5	5	
ED = Large cardboard box	0	1	1	
EL = Concrete culvert, 7 dia. x 12	0	1	1	
Fiber glass-reinforced polyester (FRP) boxes	0	70	70	
HB = 110 gal	0	32	32	
Metal boxes	1	38	39	Lead
Plywood boxes	0	20	20	
55-gal drum	3	6,987	6,990	Oil
	4	7,222	7,226	

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Table 4-36. Mixed Waste (MW) Distribution
(January 1, 1970 to December 31, 1973).

Container code and description	Total containers with MW	Total containers without MW	Total containers	Hazardous material
CA = Hanford standard carton	0	23	23	
Concrete boxes	0	22	22	
CQ = Small box, 2 ft ³	0	1	1	
CV = Vent pipes	0	7	7	
DA = High-efficiency particulate air (HEPA) filters	0	13	13	
DF = Metal container, 30 gal	0	93	93	
DH = Tanks-decon cylinder	0	1	1	
EB = Equipment	0	3	3	
EI = Iron drum, 3 x 3 x 4	0	4	4	
HB = 110 gal	0	4	4	
Metal boxes	1	86	87	Lead
Plywood boxes	0	16	16	
55-gal drum	15	10,913	10,928	Beryllium Lead Oil
	16	11,186	11,202	

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Table 4-37. Transuranic (TRU) Grams, Radiation Level, Mixed Waste (MW)--55-gal Drum. (Sheet 1 of 5)

Years	Generators	Total number of containers	Average TRU (g)	Total TRU (g)	Average radiation level (mrem/h)	Number of Containers without MW	Average alpha (Ci)	Total alpha (Ci)	Average % noncombustible	Average % combustible
1970 to 1973	DOW-RF	66	1.189 E+00	7.850 E+01	5.682 E-01	66	9.932 E-02	6.555 E+00	100	0
	JAJ-200 West	296	8.446 E-01	2.500 E+02	1.529 E+01	295	7.054 E-02	2.088 E+01	N/A ^b	N/A ^b
	LRL-LRLAB	3	2.333 E+00	7.000 E+00	2.500 E+00	3	1.948 E-01	5.845 E-01	N/A ^b	N/A ^b
	PNL-108-F	117	2.580 E-02	3.019 E+00	3.889 E+00	117	2.155 E-03	2.521 E-01	N/A ^b	N/A ^b
	PNL-144-F	4	1.675 E-04	6.700 E-04	1.000 E+00	4	1.399 E-05	5.595 E-05	N/A ^b	N/A ^b
	PNL-1705-F	4	2.000 E-04	8.000 E-04	5.000 E+00	4	1.670 E-05	6.680 E-05	N/A ^b	N/A ^b
	PNL-209-E	33	9.103 E-02	3.004 E+00	2.973 E+00	33	7.603 E-03	2.509 E-01	N/A ^b	N/A ^b
	PNL-231-Z	387	4.124 E+00	1.596 E+03	1.744 E+00	373	3.444 E-01	1.333 E+02	100	0
	PNL-308	10	5.000 E-04	5.000 E-03	1.000 E+01	10	4.175 E-05	4.175 E-04	N/A ^b	N/A ^b
	PNL-325	988	1.678 E-01	1.657 E+02	2.921 E+00	988	1.401 E-02	1.384 E+01	N/A	N/A
	WHC-105-N	2	4.000 E+00	8.000 E+00	8.000 E+01	2	3.340 E-01	6.680 E-01	N/A ^b	N/A ^b
	WHC-202-A	1,594	9.297 E-02	1.482 E+02	6.465 E+00	1,594	7.767 E-03	1.238 E+01	100	0
	WHC-202-AL	1,449	1.006 E-04	1.458 E-01	2.003 E+02	1,449	8.402 E-06	1.217 E-02	N/A ^b	N/A ^b
	WHC-221-TS	32	3.406 E-02	1.090 E+00	1.000 E+00	32	2.845 E-03	9.103 E-02	N/A ^b	N/A ^b
	WHC-222-S	143	2.097 E-01	2.999 E+01	4.902 E+00	143	1.751 E-02	2.504 E+00	N/A ^b	N/A ^b
	WHC-2345-Z	5,016	2.213 E+00	1.110 E+04	2.144 E+00	5,016	1.817 E-01	9.116 E+02	100	0
	WHC-2724-W	1	5.000 E+00	5.000 E+00		1	4.175 E-01	4.175 E-01	N/A ^b	N/A ^b
	WHC-308	25	1.280 E+00	3.200 E+01	8.680 E+00	25	4.472 E-02	1.118 E+00	N/A ^b	N/A ^b
	WHC-325	758	1.380 E+00	1.046 E+03	5.656 E+00	758	1.335 E-01	1.012 E+01	100	0
	Subvalues	10,928	1.324 E+00	1.448 E+04	2.979 E+01	10,913	1.020 E-01	1.115 E+03	100	0

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Table 4-37. Transuranic (TRU) Grams, Radiation Level, Mixed Waste (MW)--55-gal Drum. (Sheet 2 of 5)

Years	Generators ^a	Total number of containers	Average TRU (g)	Total TRU (g)	Average radiation level (mrem/h)	Number of Containers without MW	Average alpha (Ci)	Total alpha (Ci)	Average % noncombustible	Average % combustible
1974 to 1977	DOW-RF	143	1.511 E-01	2.161 E+01	7.996 E-01	143	1.262 E-02	1.805 E+00	100	0
	GES-SAN	16	3.965 E+01	6.344 E+02	N/A ^b	16	3.311 E+00	5.298 E+01	100	0
	ILL-ARGON	5	4.400 E+01	2.200 E+02	N/A ^b	5	3.675 E+00	1.837 E+01	100	0
	JAJ-200 West	17	1.000 E-01	1.700 E+00	3.000 E+01	17	8.350 E-03	1.420 E-01	100	0
	OHO-BATCO	41	2.878 E+00	1.180 E+02	5.000 E-01	41	2.403 E-01	9.854 E+00	0	100
	PNL-209-E	24	5.333 E+00	1.280 E+02	2.048 E+00	24	4.454 E-01	1.069 E+01	67	33
	PNL-231-Z	689	4.563 E+00	3.144 E+03	1.364 E+00	686	3.723 E-01	2.545 E+02	69	31
	PNL-303-C	62	1.210 E+02	7.503 E+03	3.645 E+00	62	3.263 E+00	2.023 E+02	81	19
	PNL-325	259	6.598 E-01	1.709 E+02	3.060 E+00	259	7.516 E-02	1.947 E+01	20	80
	PNL-325-A	10	1.126 E+02	1.126 E+03	1.000 E+01	10	9.370 E+00	9.370 E+01	0	100
	RI-RF	217	3.880 E+00	8.420 E+02	6.770 E-01	217	3.240 E-01	7.031 E+01	100	0
	WHC-105-KE	38	1.321 E-01	5.021 E+00	8.040 E+02	38	1.103 E-02	4.193 E-01	0	100
	WHC-2WTF	29	1.000 E-04	2.900 E-03	6.703 E+01	29	8.350 E-06	2.422 E-04	100	0
	WHC-202-A	99	9.425 E-01	9.331 E+01	1.162 E+00	99	7.870 E-02	7.792 E+00	N/A ^b	N/A ^b
	WHC-202-AL	24	1.000 E-04	2.400 E-03	2.304 E+02	24	8.350 E-06	2.004 E-04	57	43
	WHC-221-TS	2	1.000 E-04	2.000 E-04	1.000 E+00	2	8.350 E-06	1.670 E-05	N/A ^b	N/A ^b
	WHC-222-S	153	1.344 E+00	2.057 E+02	2.061 E+01	153	3.193 E-02	4.885 E+00	4	96
	WHC-234-5Z	4,388	6.219 E+00	2.729 E+04	1.176 E+00	4,388	5.194 E-01	2.279 E+03	32	68
	WHC-325	774	6.081 E+00	4.707 E+03	4.148 E+00	774	5.078 E-01	3.930 E+02	12	88
	Subvalues	6,990	6.611 E+00	4.621 E+04	7.114 E+00	6,987	4.892 E-01	3.419 E+03	37	63

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Table 4-37. Transuranic (TRU) Grams, Radiation Level, Mixed Waste (MW)--55-gal Drum. (Sheet 3 of 5)

Years	Generator ^a	Total number of containers	Average TRU (g)	Total TRU (g)	Average radiation level (mrem/h)	Number of Containers without MW	Average alpha (Ci)	Total alpha (Ci)	Average % noncombustible	Average % combustible
1978 to 1981	APA-BABCX	773	1.427 E+01	1.103 E+04	1.000 E+00	772	1.187 E+00	9.179 E+02	40	60
	BOK-BART	3	5.010 E-02	1.503 E-01	5.000 E-01	3	8.350 E-06	2.505 E-05	62	38
	CAN-ESG	40	4.225 E+00	1.690 E+02	1.000 E+00	19	3.528 E-01	1.411 E+01	53	47
	ENC-EXXON	202	1.759 E+02	3.553 E+04	1.075 E+00	202	1.469 E+01	2.967 E+03	99	1
	GE-VAL	76	2.695 E+00	2.048 E+02	1.000 E+00	23	2.250 E-01	1.710 E+01	72	28
	OHO-BATCO	42	2.226 E+00	9.350 E+01	1.000 E+00	42	1.859 E-01	7.808 E+00	0	100
	PNL-1706-K	3	3.667 E-05	1.100 E-04	1.000 E+00	0	3.062 E-06	9.186 E-06	100	0
	PNL-209-E	24	1.296 E+01	3.110 E+02	1.000 E+00	10	1.082 E+00	2.597 E+01	4	96
	PNL-231-Z	252	1.256 E+00	3.165 E+02	1.000 E+00	252	1.049 E-01	2.643 E+01	52	48
	PNL-325	307	1.700 E+00	5.220 E+02	9.626 E-01	307	1.397 E-01	4.288 E+01	3	97
	PNL-325-A	5	1.000 E+00	5.000 E+00	1.000 E+00	5	8.350 E-02	4.175 E-01	0	100
	PNL-340	78	9.185 E-01	7.164 E+01	2.987 E+00	78	7.455 E-02	5.815 E+00	44	56
	RI-RF	280	3.073 E-01	8.604 E+01	1.055 E+00	280	2.566 E-02	7.184 E+00	88	12
	WEC-WARD	231	1.882 E+00	4.347 E+02	8.448 E-01	160	1.574 E-01	3.636 E+01	45	55
	WHC-2WTF	28	3.929 E+00	1.100 E+02	5.357 E+00	28	3.281 E-01	9.186 E+00	11	89
	WHC-202-A	76	6.184 E-01	4.700 E+01	1.000 E+00	76	5.165 E-02	3.925 E+00	87	13
	WHC-202-AL	11	1.000 E-04	1.100 E-03	5.536 E+01	11	8.351 E-06	9.186 E-05	0	100
	WHC-216-29	702	8.466 E+00	5.943 E+04	1.000 E+00	702	7.068 E+00	4.962 E+03	96	4
	WHC-222-S	10	5.402 E-01	5.402 E+00	1.000 E+00	10	4.511 E-02	4.511 E-01	0	100
	WHC-233-S	57	1.316 E+00	7.500 E+01	1.000 E+00	57	1.099 E-01	6.263 E+00	40	60
	WHC-234-5Z	4,945	2.095 E+01	1.036 E+05	1.466 E+00	4,945	1.749 E+00	8.648 E+03	21	79
	WHC-325	835	1.037 E+01	8.661 E+03	2.633 E+00	835	8.732 E-01	7.291 E+02	30	70
	WHC-340	171	1.010 E+01	1.727 E+03	3.491 E+00	171	8.433 E-0	1.442 E+02	61	39
	Subvalues	9,151	1.738 E+01	1.590 E+05	1.541 E+00	8,988	2.030 E+00	1.857 E+04	36	64

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Table 4-37. Transuranic (TRU) Grams, Radiation Level, Mixed Waste (MW)--55-gal Drum. (Sheet 4 of 5)

Years	Generators	Total number of containers	Average TRU (g)	Total TRU (g)	Average radiation level (mrem/h)	Number of Containers without MW	Average alpha (Ci)	Total alpha (Ci)	Average % noncombustible	Average % combustible
1982 to 1985	APA-BABCX	374	4.989 E+00	1.866 E+03	8.287 E+00	374	4.091 E-01	1.530 E+02	54	46
	BER-LBLAB	1	4.100 E+01	4.100 E+01	1.720 E+02	1	8.350 E-02	8.350 E-02	0	100
	CAN-ESG	173	1.123 E+00	1.943 E+02	5.708 E+01	81	9.272 E-02	1.604 E+01	65	35
	ENC-EXXON	1	1.925 E+02	1.925 E+04	1.000 E+00	1	1.608 E+01	1.608 E+03	100	0
	GE-VAL	74	4.001 E+00	2.961 E+02	7.365 E-01	40	3.341 E-01	2.472 E+01	1	99
	ILL-ARGON	42	6.845 E+00	2.875 E+02	4.062 E+01	0	6.483 E-02	2.723 E+00	100	0
	KER-MCGEE	803	8.430 E+00	6.769 E+03	3.903 E+00	782	6.994 E-01	5.616 E+02	61	39
	PNL-209-E	34	1.924 E+01	6.542 E+02	8.618 E+00	34	1.607 E+00	5.463 E+01	9	91
	PNL-231-Z	32	3.063 E-01	9.800 E+00	6.734 E-01	31	2.558 E-02	8.184 E-01	52	48
	PNL-308	4	3.390 E+00	1.356 E+01	2.525 E+01	4	2.828 E-01	1.131 E+00	24	76
	PNL-318	1	1.430 E+01	1.430 E+01	1.100 E+01	1	1.009 E-02	1.009 E-02	20	80
	PNL-324	15	2.492 E+00	3.738 E+01	6.933 E+00	14	1.524 E+00	2.286 E+01	42	58
	PNL-325	3	2.420 E+00	7.260 E+00	1.200 E+01	3	1.979 E-01	5.937 E-01	57	43
	PNL-340	39	2.100 E+00	8.189 E+01	1.255 E+01	36	6.838 E-01	2.667 E+01	42	58
	RI-RF	267	4.356 E+00	1.163 E+03	5.062 E-01	261	3.568 E-01	9.527 E+01	87	13
	WEC-WARD	678	1.581 E+00	1.072 E+03	4.495 E+00	613	1.320 E-01	8.949 E+01	56	44
	WHC-202-A	404	1.772 E+01	7.158 E+03	2.313 E+00	384	1.479 E+00	5.977 E+02	22	78
	WHC-222-S	3	5.667 E+00	1.700 E+01	2.333 E+00	3	3.743 E-01	1.123 E+00	26	74
	WHC-234-SZ	5,258	1.062 E+01	5.582 E+04	1.675 E+00	5,203	8.846 E-01	4.651 E+03	15	85
	WHC-324	179	2.577 E+01	4.613 E+03	4.700 E+00	179	2.149 E+00	3.847 E+02	36	64
	WHC-340	65	1.350 E+01	8.778 E+02	2.112 E+00	61	1.127 E+00	7.326 E+01	45	55
	Subvalues	8,450	1.186 E+01	1.002 E+05	3.906 E+00	8,106	8.016 E-01	6.774 E+03	29	71
1986 to 1988	CAN-ESG	23	1.582 E+01	3.639 E+02	2.983 E+01	21	1.321 E+00	3.039 E+01	67	33
	ILL-ARGON	72	5.886 E+00	4.238 E+02	5.403 E+01	0	5.574 E-02	4.013 E+00	100	0

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Table 4-37. Transuranic (TRU) Grams, Radiation Level, Mixed Waste (MW)--55-gal Drum. (Sheet 5 of 5)

Years	Generator ^a	Total number of containers	Average TRU (g)	Total TRU (g)	Average radiation level (mrem/h)	Number of Containers without MW	Average alpha (Ci)	Total alpha (Ci)	Average % noncombustible	Average % combustible
1986 to 1988 (cont.)	KER-MCGEE	418	5.993 E+00	2.505 E+03	2.948 E+00	384	5.005 E-01	2.092 E+02	60	40
	MPR-CUPRC	1			4.500 E+01	1	N/A ^b	N/A ^b	100	0
	PNL-209-E	29	5.048 E+01	1.464 E+03	2.450 E+01	29	4.215 E+00	1.222 E+02	25	75
	PNL-308	6	1.271 E+00	7.628 E+00	2.083 E+00	5	1.073 E+01	6.436 E+01	32	68
	PNL-318	2	9.200 E+00	1.840 E+01	2.000 E+01	0	8.715 E-02	1.743 E-01	100	0
	PNL-324	1	6.720 E+00	6.720 E+00	1.300 E+01	1	5.952 E-02	5.952 E-02	100	0
	PNL-325	16	1.993 E+01	3.188 E+02	2.016 E+01	16	1.624 E+00	2.598 E+01	61	39
	PNL-3720	1	3.460 E+00	3.460 E+00	1.000 E+01	1	1.578 E-01	1.578 E-01	70	30
	SAL-IAEA	1	1.940 E+01	1.940 E+01	5.000 E-01	1	1.620 E+00	1.620 E+00	100	0
	WHC-202-A	224	5.491 E+01	1.230 E+04	4.468 E+00	97	4.585 E+00	1.027 E+03	18	82
	WHC-234-5Z	1,212	2.707 E+01	3.281 E+04	1.730 E+00	1,202	2.261 E+00	2.740 E+03	19	81
	WHC-308	56	2.771 E+01	1.552 E+03	6.830 E+00	56	2.314 E+00	1.296 E+02	36	64
	WHC-324	16	6.022 E+01	9.635 E+02	3.369 E+00	16	5.029 E+00	8.046 E+01	26	74
	WHC-327-C	13 ^d	9.885 E-01	1.285 E+01	5.269 E+01	0	8.254 E-02	1.073 E+00	100	0
	WHC-340	19	3.436 E+01	6.529 E+02	5.263 E+00	19	2.869 E+00	5.452 E+01	35	65
	Subvalues	2,110	2.532 E+01	5.342 E+04	5.347 E+00	1,849	2.128 E+00	4.491 E+03	32	68
	Grand totals and averages ^c	37,629	9.922 E+00	3.734 E+05	1.152 E+01	36,843	9.134 E-01	3.437 E+04	49	51
1970 to 1988	WHC-234-5Z	12	4.359 E+02	5.230 E+03	1.000 E+00	12	0.000 E+00	1.583 E+04	100	0
	Grand totals	37,641	--	3.786 E+05	--	36,855	--	5.020 E+04	--	--

^aAPA = Babcock Wilcox; BER = University of California, Lawrence Berkeley Laboratories; BOK = Bartleville Energy Technology Center; CAN = Energy Systems Group; DOW = Dow Chemical (Rocky Flats); ENC = Exxon Nuclear Systems; GE = General Electric; GES = General Electric, San Jose; ILL = Argonne National Laboratories; JAJ = J.A. Jones; KER = Kerr McGee; LRL = Lawrence Livermore Laboratories; OHO = Battelle, Columbus, Ohio; PNL = Pacific Northwest Laboratory; RI = Rockwell International (Rocky Flats); SLC = University of Utah, Salt Lake; UNC = United Nuclear; WEC = Ward; WHC = Westinghouse Hanford.

^bNot applicable.

^cDoes not contain 12 mg ²³⁶Pu content drums from PFP. Those drums are listed separately below.

^dContain research reactor fuel waste.

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Table 4-38. Transuranic (TRU) Grams, Radiation Level, Mixed Waste (MW)--Metal Boxes. (Sheet 1 of 2)

Years	Generator ^a	Total number of containers	Average TRU (g)	Total TRU (g)	Average radiation level (mrem/h)	Number of containers without MW	Average alpha (Ci)	Total alpha (Ci)	Average % noncombustible	Average % combustible
1970 to 1973	PNL-144-F	8	8.130 E+00	6.504 E+00	3.125 E+00	8	7.222 E-02	5.778 E-01	NA ^b	NA ^b
	PNL-231-Z	18	8.622 E+00	1.552 E+02	1.000 E+00	18	7.200 E-01	1.296 E+01	NA ^b	NA ^b
	WHC-105-C	1	8.100 E+01	8.100 E+01	2.000 E+00	0	6.764 E+00	6.764 E+00	NA ^b	NA ^b
	WHC-202-A	28	1.000 E-04	2.800 E-03	5.554 E+01	28	8.350 E+00	2.338 E-02	NA ^b	NA ^b
	WHC-234-5Z	28	4.885 E+01	1.368 E+03	1.480 E+00	28	4.078 E+00	1.142 E+02	75	--
	WHC-325	4	4.500 E-01	1.800 E+00	1.313 E+03	4	3.758 E-02	1.503 E-01	NA ^b	NA ^b
	Subvalues	87	1.853 E+01	1.612 E+03	7.924 E+01	86	1.548 E+00	1.346 E+02	75	25
1974 to 1977	PNL-242-B	1	1.000 E-03	1.000 E-03	2.000 E+00	1	8.350 E-05	8.350 E-05	100	0
	PNL-325	1	1.000 E+00	1.000 E+00	1.000 E+00	1	8.350 E-02	8.350 E-02	0	100
	PNL-3708	1	1.000 E-01	1.000 E-01	1.000 E-01	1	8.350 E-03	8.350 E-03	NA ^b	NA ^b
	WHC-202-A	3	1.000 E+00	3.000 E+00	NA ^b	3	8.350 E-02	2.505 E-01	NA ^b	NA ^b
	WHC-234-5Z	21	5.397 E+01	1.133 E+03	2.385 E+00	20	4.506 E+00	9.464 E+01	93	--
	WHC-325	12	2.700 E-01	3.240 E+00	2.525 E+01	12	2.255 E-02	2.706 E-01	0	100
	Subvalues	39	2.925 E+01	1.141 E+03	9.133 E+01	38	2.442 E+00	9.525 E+01	79	21
1978 to 1981	JAJ-200 West	2	3.000 E+01	6.000 E+01	1.000 E+00	2	2.505 E+00	5.010 E+00	70	30
	OHO-BATCO	6	1.355 E+00	8.130 E+00	1.000 E+00	6	2.069 E+01	1.241 E+02	100	0
	PNL-231-Z	1	1.000 E-02	1.000 E-02	1.000 E+00	1	8.350 E-04	8.35 E-04	100	0
	WEC-WARD	20	1.122 E+01	2.244 E+02	4.775 E-01	19	9.368 E-01	1.874 E+01	88	12
	WHC-202-A	6	5.000 E-01	3.000 E+00	2.000 E+01	6	4.175 E-02	2.505 E-01	0	100
	WHC-234-5Z	3	1.333 E+02	4.000 E+02	1.000 E+00	3	1.113 E+01	3.340 E+01	0	100

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Table 4-38. Transuranic (TRU) Grams, Radiation Level, Mixed Waste (MW)--Metal Boxes. (Sheet 2 of 2)

Years	Generator ^a	Total number of containers	Average TRU (g)	Total TRU (g)	Average radiation level (mrem/h)	Number of containers without MW	Average alpha (Ci)	Total alpha (Ci)	Average % noncombustible	Average % combustible
1978 to 1981 (cont.)	WHC-308	1	5.000 E - 02	5.000 E - 02	6.000 E + 00	1	4.175 E - 03	4.175 E - 03	75	25
	WHC-325	1	1.000 E - 04	1.000 E - 04	6.000 E + 00	1	8.350 E - 06	8.350 E - 06	25	75
	WHC-340	3	5.800 E + 00	1.740 E + 01	1.000 E + 00	3	4.843 E - 01	1.453 E + 00	98	2
	Subvalues	43	1.658 E + 01	7.128 E + 02	3.641 E + 00	42	4.832 E + 00	2.078 E + 02	70	30
1982 to 1985	APA-BABCX	25	6.800 E + 01	1.700 E + 03	7.624 E + 00	25	5.660 E + 00	1.415 E + 02	99	1
	JAJ-200 West	3	3.533 E + 01	1.060 E + 02	1.000 E + 00	3	2.951 E + 00	8.852 E + 00	43	57
	PNL-340	1	1.000 E - 04	1.000 E - 04	1.500 E + 00	1	8.350 E - 06	8.350 E - 06	100	0
	WEC-WARD	71	1.893 E + 01	1.344 E + 03	3.575 E - 01	63	1.582 E + 00	1.123 E + 02	73	27
	WHC-202-A	6	1.183 E + 02	7.095 E + 02	4.167 E + 00	6	9.875 E + 00	5.925 E + 01	63	37
	WHC-234-5Z	43	1.946 E + 02	8.367 E + 03	1.262 E + 00	43	1.625 E + 01	6.987 E + 02	81	19
	WHC-325	1	N/A	N/A	5.000 E - 01	1	N/A	N/A	100	0
	WHC-340	4	6.315 E + 01	2.526 E + 02	3.400 E + 01	3	5.273 E + 00	2.109 E + 01	74	26
	Subvalues	154	8.103 E + 01	1.248 E + 04	2.833 E + 00	145	6.764 E + 00	1.042 E + 03	79	21
1986 to 1988	PNL-209E	6	1.897 E + 02	1.138 E + 03	6.567 E + 00	6	1.584 E + 01	9.504 E + 01	55	45
	Subvalues	6	1.897 E + 02	1.138 E + 03	6.567 E + 00	6	1.584 E + 01	9.504 E + 01	55	45
	Grand totals and averages	329	5.192 E + 01	1.708 E + 04	2.396 E + 01	317	4.785 E + 00	1.574 E + 03	74	26

^aAPA = Babcock Wilcox; JAJ = J.A. Jones; OHO = Battelle, Columbus, Ohio; PNL = Pacific Northwest Laboratory; RHO = Rockwell Hanford Operations; UNC = United Nuclear; WEC = Ward, WHC = Westinghouse Hanford.

^bNot applicable.

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Table 4-39. Transuranic (TRU) Grams, Radiation Level, Mixed Waste (MW)--Fiber Glass-Reinforced Polyester Boxes.

Years	Generator ^a	Total number of containers	Average TRU (g)	Total TRU (g)	Average radiation level (mrem/h)	Number of containers without MW	Average alpha (Ci)	Total alpha (Ci)	Average % noncombustible	Average % combustible
1974 to 1977	JAJ-200 West	6	3.333 E+00	2.000 E+01	4.200 E+01	6	2.733 E-01	1.640 E+00	100	0
	WHC-105-KE	2	1.640 E+01	3.280 E+01	1.250 E+03	2	1.370 E+00	2.739 E+00	0	100
	WHC-202-A	1	1.680 E+02	1.680 E+02	1.000 E+00	1	1.402 E+01	1.402 E+01	0	100
	WHC-234-5Z	61	9.482 E+01	5.784 E+03	1.656 E+00	61	7.918 E+00	4.830 E+02	88	12
	Subvalues	70	8.578 E+01	6.005 E+03	4.077 E+01	70	7.163 E+00	5.014 E+02	85	15
1978 to 1981	GE-VAL	4	7.525 E-02	3.010 E-01	5.000 E-01	4	6.283 E-03	2.513 E-02	100	0
	PNL-209-E	1	2.800 E+01	2.800 E+01	2.500 E+01	1	2.338 E+00	2.338 E+00	0	100
	PNL-231-Z	19	5.437 E+01	1.033 E+03	1.516 E+00	19	4.540 E+00	8.626 E+01	100	0
	WEC-WARD	22	2.937 E+00	6.461 E+01	4.136 E-02	22	2.407 E-01	5.295 E+00	96	4
	WHC-105-KE	5	1.736 E+01	8.680 E+01	2.620 E+03	5	1.450 E+00	7.249 E+00	0	100
	WHC-202-A	4	5.225 E+01	2.090 E+02	2.250 E+00	4	4.363 E+00	1.745 E+01	60	40
	WHC-222-S	1	1.000 E+00	1.000 E+00	NA ^b	1	8.350 E-02	8.350 E-02	95	5
	WHC-234-5Z	36	4.014 E+01	1.445 E+03	5.256 E+00	36	3.353 E+00	1.207 E+02	44	56
	Subvalues	92	3.117 E+01	2.868 E+03	1.452 E+02	92	2.602 E+00	2.394 E+02	69	31
1982 to 1985	GE-VAL	39	8.662 E-02	3.378 E+00	5.000 E-01	39	7.233 E-03	2.821 E-01	30	70
	WEC-WARD	1	2.200 E-01	2.200 E-01	2.000 E-02	1	1.837 E-02	1.837 E-02	100	0
	Subvalues	40	8.995 E-02	3.598 E+00	4.880 E-01	40	7.512 E-03	3.005 E-01	32	68
	Grant totals and averages	202	4.394 E+01	8.876 E+03	8.034 E+01	202	3.669 E+00	7.411 E+02	67	33

^aGE = General Electric; JAJ = J.A. Jones; PNL = Pacific Northwest Laboratory; WEC = Ward; WHC = Westinghouse Hanford Company.

^bNot applicable.

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Table 4-40. Transuranic (TRU) Grams, Radiation Level, Mixed Waste (MW)--Concrete Box.

Years	Generator ^a	Total number of containers	Average TRU (g)	Total TRU (g)	Average radiation level (mrem/h)	Number of containers without MW	Average alpha (Ci)	Total alpha (Ci)	Average % noncombustible	Average % combustible
1970 to 1973	WHC-234-5Z	1	2.000 E + 01	2.000 E + 01	NA ^b	1	1.670 E + 00	1.670 E + 00	NA ^b	NA ^b
	WHC-325	16	1.376 E - 01	2.201 E + 00	1.305 E + 03	16	1.149 E - 02	1.838 E - 01	NA ^b	NA ^b
	WHC-327-C	5	1.000 E - 04	5.000 E - 04	1.000 E + 00	5	8.350 E + 00	4.175 E - 02	NA ^b	NA ^b
	Subvalues	22	1.009 E + 00	2.220 E + 01	9.943 E + 02	22	8.427 E - 02	1.854 E + 00	NA ^b	NA ^b
1974 to 1977	GE-VAL	22 ^c	2.138 E + 02	4.704 E + 03	4.390 E + 01	22	1.785 E + 01	3.928 E + 02	NA ^b	NA ^b
	PNL-325	4	1.000 E + 00	4.000 E + 00	7.750 E + 01	4	8.351 E - 02	3.340 E - 01	100	0
	WHC-325	1	1.000 E - 01	1.000 E - 01	5.000 E + 01	1	8.350 E - 03	8.350 E - 03	0	100
	Subvalues	27	1.744 E + 02	4.708 E + 03	4.931 E + 01	27	1.456 E + 01	3.931 E + 02	75	25
1978 to 1981	WHC-325	9	7.778 E - 01	7.000 E + 00	5.733 E + 01	9	6.495 E - 02	5.645 E - 01	11	89
	Subvalues	9	7.778 E - 01	7.000 E + 00	5.733 E + 01	9	6.495 E - 02	5.645 E - 01	11	89
	Grand totals and averages	58	8.168 E + 02	4.737 E + 03	3.918 E + 02	58	6.820 E + 00	3.956 E + 02	31	69

^aGE = General Electric; PNL = Pacific Northwest Laboratory; WHC = Westinghouse Hanford Company.^bNot applicable.^cContain research reactor fuel waste.

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Table 4-41. Transuranic (TRU) Grams, Radiation Level, Mixed Waste (MW)--Plywood Box.

Years	Generator ^a	Total number of containers	Average TRU (g)	Total TRU (g)	Average radiation level (mrem/h)	Number of containers without MW	Average alpha (Ci)	Total alpha (Ci)	Average % noncombustible	Average % combustible
1970 to 1973	WHC-WADCO	15	2.920 E + 00	4.380 E + 01	NA ^b	15	1.398 E + 00	2.097 E + 01	NA ^b	NA ^b
	WHC-234-5Z	1	2.048 E + 00	2.048 E + 00	1.000 E + 00	1	1.710 E - 01	1.710 E - 01	NA ^b	NA ^b
	Subvalues	16	2.866 E + 00	4.585 E + 01	1.000 E + 00	16	1.322 E + 00	2.114 E + 01	NA ^b	NA ^b
1974 to 1977	WHC-105-K	15	4.064 E - 01	6.096 E + 00	1.184 E + 03	15	3.394 E - 02	5.090 E - 01	13	87
	WHC-325	5	1.000 E - 01	5.000 E - 01	1.000 E + 01	5	8.350 E - 03	4.175 E - 02	NA ^b	NA ^b
	Subvalues	20	3.298 E - 01	6.596 E + 00	8.905 E + 02	20	2.754 E - 02	5.508 E - 01	13	87
1978 to 1981	WHC-325	1	1.000 E + 00	1.000 E + 00	6.000 E + 00	1	8.350 E - 02	8.350 E - 02	0	100
	Subvalues	1	1.000 E + 00	1.000 E + 00	6.000 E + 00	1	8.350 E - 02	8.350 E - 02	0	100
	Grand totals and averages	37	1.444 E + 00	5.344 E + 01	8.099 E + 02	37	5.886 E - 01	2.178 E + 01	13	88

^aWHC = Westinghouse Hanford Company.^bNot applicable.

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Table 4-41A. Transuranic (TRU) Grams, Radiation Level, Mixed Waste (MW)--Casks and Other Containers. (Sheet 1 of 3)

Years	Generator ^a	Total number of containers	Average TRU (g)	Total TRU (g)	Average radiation level (mrem/h)	Number of containers without MW	Average alpha (Ci)	Total alpha (Ci)	Average % noncombustible	Average % combustible
1970 to 1973	PNL-231-Z	6	1.000 E - 01	6.002 E - 01	1.000 E + 00	6	8.353 E - 03	5.012 E - 02	N/A ^b	N/A ^b
	PNL-308	13	1.385 E - 04	1.800 E - 03	2.923 E + 00	13	1.156 E - 05	1.503 E - 04	N/A ^b	N/A ^b
	PNL-325	23	1.000 E - 04	2.300 E - 03	8.261 E + 00	23	8.352 E - 06	1.921 E - 04	N/A ^b	N/A ^b
	PNL-3706	1	5.000 E - 03	5.000 E - 03	3.000 E + 00	1	4.175 E - 04	4.175 E - 04	N/A ^b	N/A ^b
	WHC-202-A	27	1.080 E + 00	2.915 E + 01	1.354 E + 02	27	9.015 E - 02	2.434 E + 00	N/A ^b	N/A ^b
	WHC-202-AL	15	1.000 E - 04	1.500 E - 03	7.067 E + 01	15	8.353 E - 06	1.253 E - 04	N/A ^b	N/A ^b
	WHC-222-S	7	2.689 E - 02	1.882 E - 01	5.001 E + 03	7	2.246 E - 03	1.572 E - 02	N/A ^b	N/A ^b
	WHC-234-5Z	18	2.670 E + 00	4.806 E + 01	3.778 E + 00	18	2.229 E - 01	4.013 E + 00	100	0
	WHC-308	1	1.000 E - 03	1.000 E - 03	5.000 E + 00	1	8.350 E - 05	8.350 E - 05	N/A ^b	N/A ^b
	WHC-325	29	6.621 E - 04	1.920 E - 02	2.431 E + 01	29	5.528 E - 05	1.603 E - 03	N/A ^b	N/A ^b
	WHC-3708	9	1.000 E - 04	9.000 E - 04	1.000 E + 00	9	8.350 E - 06	7.515 E - 05	N/A ^b	N/A ^b
	Subvalues	149	5.237 E - 01	7.803 E + 01	2.735 E + 02	149	4.373 E - 02	6.515 E + 00	100	0
1974 to 1977	JAJ-200 West	5	1.400 E + 00	7.000 E + 00	1.000 E + 00	5	1.169 E - 01	5.846 E - 01	100	0
	PNL-242B	2	1.000 E - 03	2.000 E - 03	2.000 E + 00	2	8.350 E - 05	1.670 E - 04	100	0
	PNL-303C	8	1.920 E + 02	1.536 E + 03	8.000 E + 00	8	1.819 E + 00	1.455 E + 01	0	100
	PNL-325A	11	6.381 E - 01	7.019 E + 00	5.127 E + 02	11	5.328 E - 02	5.861 E - 01	N/A ^b	N/A ^b
	WHC-105-KE	4	1.873 E - 01	7.490 E - 01	3.000 E + 02	4	1.564 E - 02	6.255 E - 02	0	100
	WHC-105-N	1	1.000 E - 04	1.000 E - 04	2.000 E + 02	1	8.350 E - 06	8.350 E - 06	N/A ^b	N/A ^b
	WHC-202-A	8	1.000 E - 04	8.000 E - 04	1.000 E + 00	8	8.350 E - 06	6.680 E - 05	N/A ^b	N/A ^b

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Table 4-41A. Transuranic (TRU) Grams, Radiation Level, Mixed Waste (MW)--Casks and Other Containers. (Sheet 2 of 3)

Years	Generator*	Total number of containers	Average TRU (g)	Total TRU (g)	Average radiation level (mrem/h)	Number of containers without MW	Average alpha (Ci)	Total alpha (Ci)	Average % noncombustible	Average % combustible
	WHC-222-S	2	3.830 E-01	7.660 E-01	6.000 E+00	2	3.198 E-02	6.396 E-02	N/A ^b	N/A ^b
	WHC-234-5Z	23	1.078 E+00	2.480 E+01	1.973 E+00	23	9.004 E-02	2.071 E+00	48	52
	WHC-325	16	6.875 E-02	1.100 E+00	2.756 E+01	16	5.744 E-03	9.190 E-02	83	17
	Subvalues	80	1.972 E+01	1.577 E+03	9.028 E+01	80	2.251 E-01	1.801 E+01	54	46
1978 to 1981	PNI-324	10	1.600 E+00	1.600 E+00	9.500 E+01	0	1.336 E-01	1.336 E+00	50	50
	PNI-325	11	1.090 E+00	1.199 E+01	6.000 E+00	11	9.100 E-02	1.001 E+00	0	100
	WHC-105-KE	1	1.400 E+00	1.400 E+00	1.900 E+01	1	1.169 E-01	1.169 E-01	0	100
	WHC-234-5Z	83	5.176 E+01	4.296 E+03	1.235 E+01	76	4.322 E+00	3.587 E+02	43	57
	WHC-327-C	3	9.977 E+02	2.993 E+03	7.500 E+00	1	8.333 E+01	2.500 E+02	100	0
	Subvalues	108	6.763 E+01	7.304 E+03	1.928 E+01	89	5.659 E+00	6.112 E+02	40	60
1982 to 1985	APA-BABCX	1	1.600 E-02	1.600 E-02	4.000 E-02	1	1.336 E-03	1.336 E-03	100	0
	GE-324	6	9.875 E+01	5.925 E+02	1.433 E+02	0	8.247 E+00	4.948 E+00	100	0
	WHC-105-N	1	1.258 E+02	1.258 E+02	1.300 E+01	1	6.138 E+00	6.138 E+00	100	0
	WHC-234-5Z	109	1.042 E+02	1.136 E+04	2.156 E+00	106	8.701 E+00	9.484 E+02	100	0
	WHC-327-C	1	6.090 E+02	6.090 E+02	2.000 E+01	1	5.085 E+01	5.085 E+01	100	0
	Subvalues	118	1.075 E+02	1.269 E+04	9.558 E+00	109	8.562 E+00	1.010 E+03	100	0

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Table 4-41A. Transuranic (TRU) Grams, Radiation Level, Mixed Waste (MW)--Casks and Other Containers. (Sheet 3 of 3)

Years	Generator ^a	Total number of containers	Average TRU (g)	Total TRU (g)	Average radiation level (mrem/h)	Number of containers without MW	Average alpha (Ci)	Total alpha (Ci)	Average % noncombustible	Average % combustible
1986 to 1988	OHO-BATCO	1	1.000 E - 04	1.000 E - 04	1.600 E + 02	0	8.350 E - 06	8.350 E - 06	100	0
	PNL-324	1	7.720 E + 00	7.720 E + 00	5.000 E + 01	0	6.447 E - 01	6.447 E - 01	100	0
	WHC-324	5	1.962 E + 03	9.811 E + 03	6.080 E + 01	0	1.639 E + 02	8.193 E + 02	100	0
	Subvalues	7	1.403 E + 03	9.819 E + 03	7.343 E + 01	0	1.171 E + 02	8.199 E + 02	100	0
	Grand totals and averages ^c	462	6.811 E + 01	3.147 E + 04	1.119 E + 02	427	5.338 E + 00	2.466 E + 03	71	29

^aAPA = Babcock Wilcox; GE = General Electric; JAJ = J. A. Jones; OHO = Battelle, Columbus, Ohio; PNL = Pacific Northwest Laboratory; WHC = Westinghouse Hanford.

^bNot applicable.

^cContains research reactor fuel waste.

PST89-3122-4-41A

5.0 RETRIEVAL INFORMATION

The TRU waste containers (38,729) have been retrievably stored in 25 trenches and three buildings in the 200 Areas since 1970. Collectively, the containers comprise a volume of 544,500 ft³.

Typical onsite waste packages used for radioactive wastes at the Hanford Site are summarized below.

- **Low-Level Waste**

- **Cardboard boxes**--Used for slightly contaminated MFP wastes, such as wiping tissue.
- **Plastic shrouds**--Failed equipment that could not be repaired; wrapped in sheet plastic and placed into the burial trench.
- **Steel drums**--Used for grossly contaminated MFP wastes, such as rags and small pieces of hardware.
- **Wooden, concrete, and steel boxes**--Used for large equipment contaminated with MFP, depending on size, weight, and radioactivity.
- **Casks**--Used for high-radiation material, placed in retrievable storage.

- **Transuranic Wastes in Retrievable Storage**

- **Steel drums and galvanized drums**--Used for miscellaneous small items containing or suspected of containing TRU elements that must be placed in retrievable storage. The current limit for transuranic elements is 100 nCi/g of waste; the limit was 10 nCi/g from 1973 to 1982.
- **Steel boxes**: Used for contaminated equipment too large to place in drums.
- **Fiber glass-reinforced polyester plywood, double-walled boxes**--Special boxes used for large equipment being removed from the shutdown of various Hanford Site facilities.
- **Fiber glass-reinforced polyester, single-walled boxes**--Construction was based on early Rocky Flats design; dimensions were 4 ft by 4 ft by 7 ft. They were single-walled and contained contaminated equipment too large for drums.
- **Plywood boxes**--Originally designed to transport waste from PFP to the burial grounds, they contained contaminated equipment too large to place in drums.
- **Casks**--Used to ship spent naval-reactor cores and components that were heavily shielded, permitting them to be placed in retrievable storage.
- **Card board boxes, plastic shrouds, dump trucks, and other miscellaneous containers** (see appendix B)--Used for for containment of TRU-contaminated material in the early 1970's.

The containers vary in size from 30-gal drums (4 ft³) to 9 ft by 12.7 ft by 20 ft (2,286 ft³) boxes. Containers were emplaced at burial sites on a by-shipment basis from 1970 to 1982. After 1982, records should provide individual container location.

Burial trench locations are marked only by external (ground-level) survey-marker monuments placed every 25 ft around the burial-ground perimeter. Asphalt pads have no internal trench markings (lines, markings, or numbers) on the asphalt deck (Figure 5-1). Earthen-bottom trenches, likewise, have no internal trench markings. Waste placement locations within the trenches were determined by pacing off or measuring (with a tape) the distance from the beginning or end of the trench. (Distance from the beginning or end of the trench to the actual survey marker is estimated. The survey marker is about 16 ft above the trench floor.) The beginning, end, and midpoint of waste modules were determined in this manner. (A waste module for drums is 12 wide by 12 long by 4 or 5 drums high, usually 4 drums high.)

Waste-module coordinates are included on burial forms. Module container-location forms also have been filled out since about 1975 to show container location within each module. These forms were not used for TRU waste V-style trenches or trenches that had waste emplaced horizontally. Only overall module coordinates are tracked on the R-SWIMS data base, not individual container locations within the module. Burial-form drawings showing waste emplacement also exist, but only for asphalt pad, retrievably stored TRU waste.

Drawings exist for only two TRU waste trenches with waste emplacement details. No detailed photographic record exists for waste emplacement in trenches; however, sporadic photographs have been taken over the years. This photographic record is not sufficient to verify container placement within trenches or to build an emplacement history supporting compliance with directives and regulations.

The TRU waste containers are placed in temporary storage before final placement within trenches. The temporary storage locations are 224-T, a large asphalt staging area across from the 4B burial ground, and areas along several trenches. The waste location is put on the Solid Waste Storage Record-Transuranic once the waste is moved from temporary storage to a permanent trench location. Several containers have been kept in temporary storage for up to 5 yr because they are out of compliance with burial-ground regulations.

Drums were stacked horizontally in earthen trenches from 1970 to 1972. After this period they were stacked in V trenches at about 30° from vertical for a 6-mo time period and since then have been stacked vertically. These variations in drum emplacement may require additional engineering design, procedures, and training (beyond that required for vertical placement) to safely and effectively retrieve stored-waste containers.

Approximately half of the waste volume in retrievable storage is emplaced as shown in Figure 5-2. Waste containers are intermixed (boxes with drums, etc.) within trenches. Waste types (LLW and TRU) are sometimes segregated and sometimes intermixed within retrievably stored trenches.

The TRU retrievable containers have been identified by painted numbers and stick-on labels on the containers as well as tamperproof, numbered seals, starting in 1981. Container labeling methods are not long-lived, or were not tracked, and will provide little positive container identification information (for containers emplaced before 1982) at retrieval.

From 1970 to 1984 TRU waste containers were tracked on a per-shipment basis only. Information that may have existed during this time period to track individual containers is not recoverable from the data base.

The paint for numbering drums was a Krylon® spray-on paint, which has probably deteriorated. In 1982, an acceptable paint list for labeling galvanized drums was issued.

Since the earlier Krylon paint has most likely deteriorated, the painted numbers on drums will not aid in positive identification of drums or other containers emplaced before 1983.

Stick-on labels will also serve no verifiable proof of containers as most of the labels deteriorate 7 to 10 yr after application.

Copper alloy, tamperproof seals were attached to drums (and some other containers) with stainless steel wire starting in 1981. The seals would have provided a positive one-to-one identification of containers at retrieval even if the storage location was not accurately noted on storage records. Unfortunately, seal information was never input into the data base, except during 1984. A field was created for seal numbers using the NOMAD 2 system in early 1984, but seal number input was discontinued by the end of the year.

The Hanford Site has climatic and geological features that make the site well suited for TRU waste burial and storage operations. The Hanford Site is located in a semi-arid environment having an average annual precipitation of approximately 6 in. Direct precipitation over the Hanford Site largely evaporates, leaving a small amount for plant uptake and runoff.

Routine surface surveillance includes measurement of surface radiation levels, sampling plant growth for radionuclide uptake, and visual inspection for subsidence, animal burrows, and wind erosion. Deficiencies are corrected as necessary.

5.1 BACKGROUND ON BURIAL GROUNDS AND TRENCHES

Four main burial ground sites have been used for storage of CH-TRU wastes. These four underground trench storage areas consist of burial grounds 218-W-3A (Figure 5-3), 218-W-4B (Figure 5-4), 218-W-4C (Figure 5-5), and 218-E-12B (Figure 5-6). Also used as CH-TRU storage sites are buildings 212-N and 212-P in the 200 North Area and the TRUSAF, 224-T.

A typical asphalt trench burial ground is shown in Figure 5-9. Storage containers are intermixed in several trenches, boxes with drums, etc. (Figure 5-7). Several trenches contain both LLW and TRU waste (Table 5-2). The interface between these waste types is unknown at this time.

Several modes of storage have been used for TRU wastes. A discussion of TRU storage in 212-N, 212-P, and 224-T will not be included in this section. The TRU waste storage at these three locations is aboveground, protected from the elements, and within concrete buildings or attached structures. As such, storage in this mode should not be subject to problems encountered in underground trench storage.

Storage evolution in trenches has yielded varying storage methods from 1970 to present. Containers have been placed directly in earthen trenches. Drums have been placed horizontally, skewed about 30 degrees from vertical in a V trench, and stacked vertically. Boxes have been placed directly in earthen trenches with plywood and dimensional lumber under them (Figure 5-8). Most large plywood boxes were emplaced using drag-off methods. This method of emplacement may have been selected because of the high-radiation level recorded in the R-SWIMS (Table 4-41). Waste coverage was performed periodically. Waste containers were in the open for 1 1/2 yr (some up to 5 yr)

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before a nylon tarp was installed. This practice probably has increased the deterioration rate of these containers. Containers have been placed on asphalt pads (Figures 5-9 and 5-10). Plywood has been placed beneath the stacks, between the layers of the containers, and atop the stack. Some containers have been wrapped in polyethylene sheeting. Most container storage has fire-retardant plywood between layers, atop the stack, and are covered with a tarp to prevent moisture entry.

The installation of risers can provide a moisture path because of insufficient installation instructions (Figure 5-11); see Section 6.1.

5.1.1 Burial Ground 218-E-12B

The 12B burial ground is the only burial ground with stored, TRU waste located in the 200 East Area. The burial ground location is shown in Figure 5-6. The 12B burial ground contains 2,874, 55-gal drums; 28 metal boxes; and 42 miscellaneous containers. The TRU wastes were first emplaced in May 1970 with the last emplacement occurring in December 1973.

The 12B burial ground was the first Hanford Site burial ground to receive segregated TRU wastes. Drums were placed horizontally with direct soil coverage. The containers were placed in the earthen trench without plywood or nylon tarp coverage.

All of the CH-TRU waste stored in these trenches was contaminated with or suspected of being contaminated with TRU radionuclides.

5.1.2 Burial Ground 218-W-3A

The 3A burial ground location is shown in Figure 5-3. It consists of 14 trenches containing 3,267, 55-gal drums; 186 boxes; 78, 30-gal drums; and 35 casks, cartons, and miscellaneous containers. These storage containers constitute a TRU waste volume of 144,900 ft³. The TRU wastes were first emplaced in the burial ground in May 1970, and the last waste was emplaced on April 1988. The 3A burial ground has no asphalt pads and used only earthen-bottom (gravel-fill) trenches.

A relatively small number of drums were placed in the 3A burial ground. Some of the drums contained classified material from Rocky Flats (and other sites) and were stacked horizontally with the other waste until 1975. After 1975, the classified material was segregated from other wastes and stacked vertically in earthen-bottom trenches.

The waste drums were stacked horizontally from 1970 to approximately 1974. During this time period, no tarp or plywood was used to cover the waste. The actual date when tarp coverage was initiated has not been established. It appears to vary based on types of containers and the storage area. After the transition period, drums were stacked vertically and placed on plywood; the completed module was covered with nylon tarps and plywood before soil emplacement.

Most of the stored plywood boxes (54%) and FRP boxes (62%) are in burial ground 3A. Trench 17 is a wide-bottom trench used for storage of several boxes. Trench 17 is also the location of the first retrievably stored, FRP box. A drawing of the box locations and typical box drawings are included in Appendix C for background information. Trench 18, which is immediately adjacent to trench 17, has not been used for waste and should not be used until the retrieval of the large boxes from trench 17 is complete.

Offsite wastes were placed in several 3A trenches: TS6, TS9, TO4, TO5, TO8, T17, and T23. Many of the 3A trenches contain a very small number of CH-TRU waste containers that were emplaced before the 10 nCi/g TRU limit. Essentially all of the CH-TRU waste stored in these trenches was contaminated or suspected of being contaminated with TRU radionuclides.

5.1.3 Burial Ground 218-W-4B

The 4B burial ground location is shown in Figure 5-4. It consists of 14 trenches containing 12,426, 55-gal drums; 133 boxes; 48, 110-gal and 30-gal drums; and 44 miscellaneous containers. These containers constitute a TRU waste volume of 115,500 ft³. The TRU waste was first emplaced in 4B in August 1970, with the last waste being emplaced in September 1978.

Trenches 07 and 11 were designated to receive radioactive solid wastes contaminated or potentially contaminated with more than 10 nCi/g of TRU radionuclides for retrieval.

Trench 07 is divided into two sections; each section is designed to receive TRU waste that can be retrieved as contamination-free packages. From W77478 through W77553 is a concrete-lined V trench, referred to as trench TV-7; see Figure 5-12. The section of the trench from W77683 through W78016 is an asphalt pad, referred to as trench TO7 (Figure 5-4).

The concrete V trench contains 55- and 30-gal drums. A metal cover and several feet of earth isolate the drums from the environment. In the asphalt-pad storage, drums are segregated into 55-gal drums, and labeled combustible or noncombustible. They are stacked vertically in modules of 12 by 12 by 4 drums, with each layer of drums separated by plywood and reinforced nylon sheeting before covering with 4 ft of earth. In trench 07 the section from W77928 through W78016 contains metal or concrete burial boxes, hoods, and other odd-size items. The noncombustible drums are located at W77731.

Trench 11 is a solid TRU waste burial trench as seen in Figure 5-13. The majority of the waste in this trench is packaged in 55-gal drums, buried from W77845 through W78644. Other containers, such as concrete or steel burial boxes, duct work, stainless steel tanks, and a culvert, are located at W77516 through W77833. Drums were stacked horizontally on the earthen floor before 1973.

Most of the waste buried was described as laboratory waste (assumed to be paper, rubber, plastic, glass, and gloves). Other typical waste items were glovebox waste, hood waste, filters, scrap pumps and valves, process waste, and piping.

Color coding of containers was begun in 1975: red for combustible and black for noncombustible. Combustibles and noncombustibles were separated by module within trenches T07 and T11.

The CH-TRU waste stored in these trenches was contaminated with or suspected of being contaminated with TRU radionuclides. Although the 100 nCi/g level was established in 1982, the capability to accurately assay to this level was not in place until 1985 when the TRUSAF became operational. The segregation practices probably reduced the quantity of suspect TRU waste stored in these trenches.

5.1.4 Burial Ground 218-W-4C

The 4C burial ground location is shown in Figure 5-5. It consists of six trenches containing 17,697, 55-gal drums; 22 casks; 264 boxes; and 193 miscellaneous containers. Collectively, the TRU

waste volume in 4C is $2.457 \text{ E} + 05 \text{ ft}^3$. Most of the CH-TRU waste was emplaced in the 4C area after the 100 nCi/g level was established in 1982.

The TRU waste was first emplaced in burial ground 4C in March 1978, and, although the trench is still active today, the last waste emplaced was shown as May 1988. Trench T19 contains only one drum of CH-TRU waste that is intermixed with LLW. This drum contains 0.00000835 μCi and is calculated to have an activity level of 0.09 nCi/g. Trench T19 should be evaluated for redesignation as an LLW trench.

The wastes in Burial Ground 218-W-4C are all stored on asphalt pads covered with plywood and nylon tarps. Drums are all stacked vertically. Trenches contain boxes intermixed with drums.

During early 1980, a heavy snowfall and rapid melting caused flooding within some 4C trenches. Drums were observed floating in trench T04 and were recovered undamaged. The drums were galvanized; consequently, the corrosion affects of this occurrence are believed to be minimal. An attempt will be made to obtain a sample from these drums to verify their condition as part of Phase 2 of the characterization program (B.C. Anderson 1989).

Investigations are underway to identify incidences of this type that may affect the storage life of containers. The following practices will be evaluated as part of determining the specific locations where drums will be obtained to support Phase 2 of this characterization program.

- The practice of leaving containers uncovered for 2 yr (some up to 5 yr) may have resulted in accelerated deterioration. Investigations will be made to identify areas where containers were left uncovered over long ($> 2\text{yr}$) periods.
- Trench drainage is not considered to be a variable; however, periods of high precipitation may have an influence on container life.
- The possibility of contamination spread that could occur because of breached containers will be determined by analyzing soil samples during the retrieval and sampling efforts as described in WHC-EP-0226 (Anderson and Duncan 1989).

5.2 SUMMARY AND CONCLUSIONS: BURIAL GROUNDS AND TRENCHES

A successful retrieval program for stored CH-TRU waste must evaluate waste, container, storage, and trench information, as contained in the R-SWIMS data base and in written reports, that has accumulated over the lifetime of TRU retrievable storage.

Several areas of concern have been identified as follows:

- The date when tarps were used to cover waste. The information in Section 6.0 indicates that this is the key issue in projecting container lifetime
- The accuracy of recorded waste location versus actual location
- Temporary storage of CH-TRU containers not only perturbs completion of storage forms and input into the R-SWIMS data base, but subjects containers to weathering and subsequent corrosion

- The R-SWIMS data base information should be readily available to retrieval personnel to provide a ready access to information. This ready access will aid in identifying and minimizing hazards that may be encountered during retrieval.

The first two are expected to remain areas of uncertainty, potentially increasing the time necessary for retrieval. The third area is not expected to be significant and will be resolved eventually as waste is shipped to the WIPP. The fourth area is being addressed at Westinghouse Hanford Company (Westinghouse Hanford).

Table 5-1 provides a summary of the TRU waste containers' emplacement per burial ground and trench. Table 5-2 provides information on first and last waste emplacement dates as well as waste volume (in cubic feet) per trench. The small number and volume of TRU waste containers in several trenches coupled with the reclassification of TRU wastes to 100 nCi/g suggests that most of this waste will be designated as LLW after it has been retrieved and processed in WRAP.

To aid in this evaluation, an overview of TRU trench waste emplacement by year is provided as shown in Figure 5-14. Also, active trenches are indicated by the year of last waste emplacement. Table 5-3 provides a summary of the volume, weight, and activity in each trench. The activity level for each trench was calculated two ways. The first was for the TRU waste portion, using the same assumptions as stated in Section 4.9 (i.e., discounted for container weight). The second was for the total trench. The assumptions for the trench assumed that the low-level and TRU waste were the same density and the container weight was included as waste weight. These assumptions, in effect, average all of the contents in the trench. The total curie and container weight are shown in Table 5-3. Calculated activity level for both calculations are shown in Table 5-2.

This information plus the information in the other tables has resulted in the following conclusions.

1. Area 12B was the initial attempt at emplacing CH-TRU waste in retrievable storage in the 200 East Area. The waste was stored horizontally without tarp coverage before soil coverage. These conditions increase the container deterioration rate, as discussed in Section 6.0. The average activity of this waste is below 100 nCi/g; consequently, most of this waste will be dispositioned as LLW when processed in the WRAP Facility.
2. Area 3A contains a number of trenches with small volumes of TRU waste adjacent to LLW. These trenches are TS6, TS9, T01, T04, T05, T10, T15, T23, T30, T32, and T34. The remaining trenches, T06, T08, and T17, contain higher volumes of TRU waste. The date when waste in this area was covered with a tarp before soil coverage has not been established; however, it is estimated to be 1974. Supporting documents and other files are being reviewed to establish the date and trenches where the protective tarp was used.

Evaluation of the waste-container condition in this area should be determined as soon as practicable so the design of a portable full-containment retrieval facility can be initiated. The retrieval of breached waste containers will require personnel to wear protective clothing and respiratory protection. Retrieval under these conditions will be a very slow process.

3. Trench 18 of 3A should not be used for current waste disposal until the retrieval of the large boxes stored in trench 17 is completed. This action will expand the number of options available when retrieving this waste.

4. Area 4B was the first area in 200 West Area where CH-TRU waste was placed in retrievable storage. The trenches in this area present the transition from the old storage methodology (i.e., horizontal stacking of drums and direct soil cover) to retrievable storage configurations (i.e., engineered storage structure represented by TV-7 and the asphalt pad and vertical stacking of drums with plywood and tarps before soil coverage).
5. Area 4C contains trenches that used the new retrievable storage methodology developed in area 4B, except for trench T19 which contains one drum mixed with a large quantity of LLW. The average projected activity for this drum is 0.2 nCi/g.

Figure 5-1. Transuranic Retrievable Storage--Burial
Ground 4C, 200 West Area (8803743-2cn).

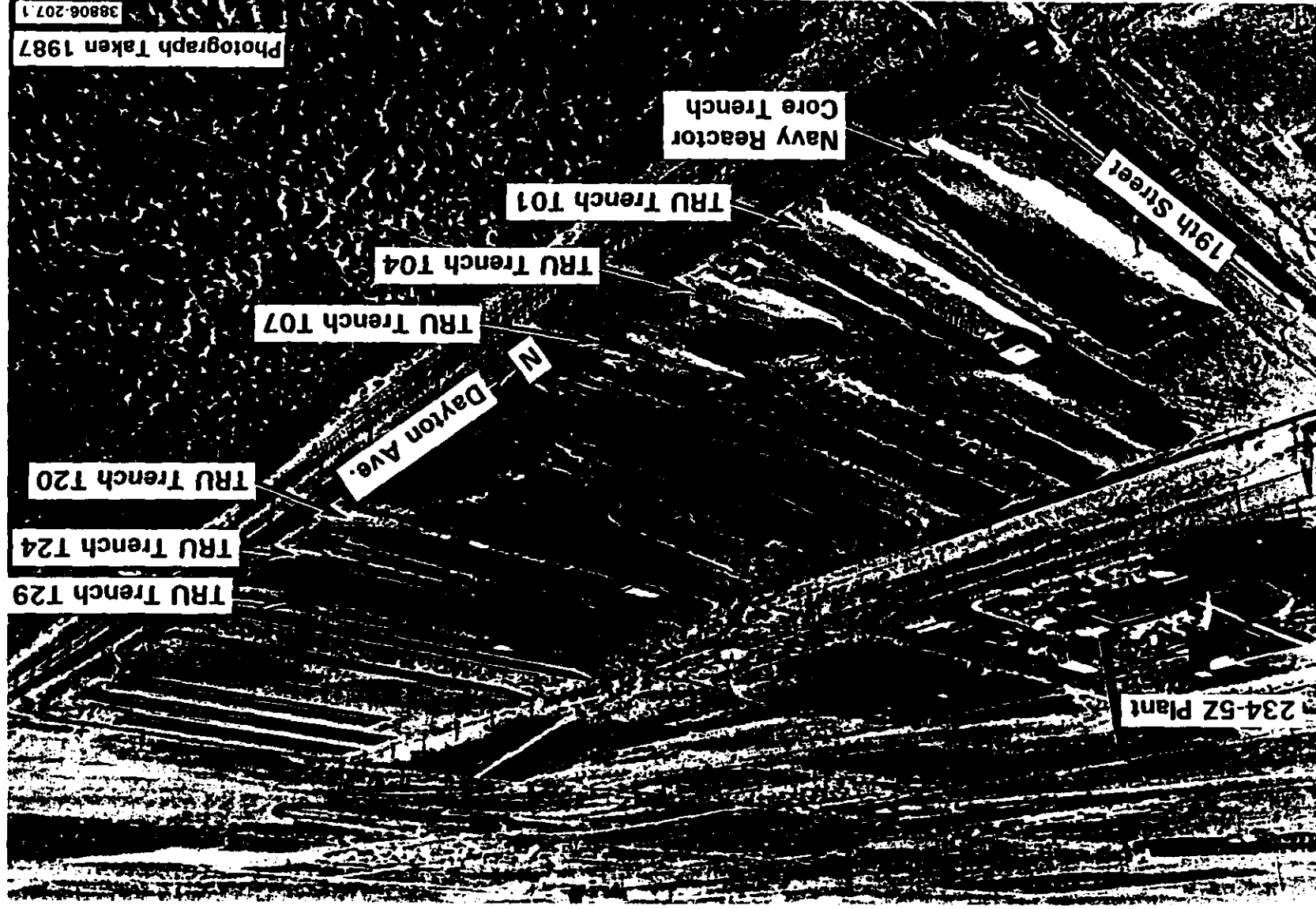


Figure 5-2. Typical Post-1972 Transuranic Waste Retrievable Storage.

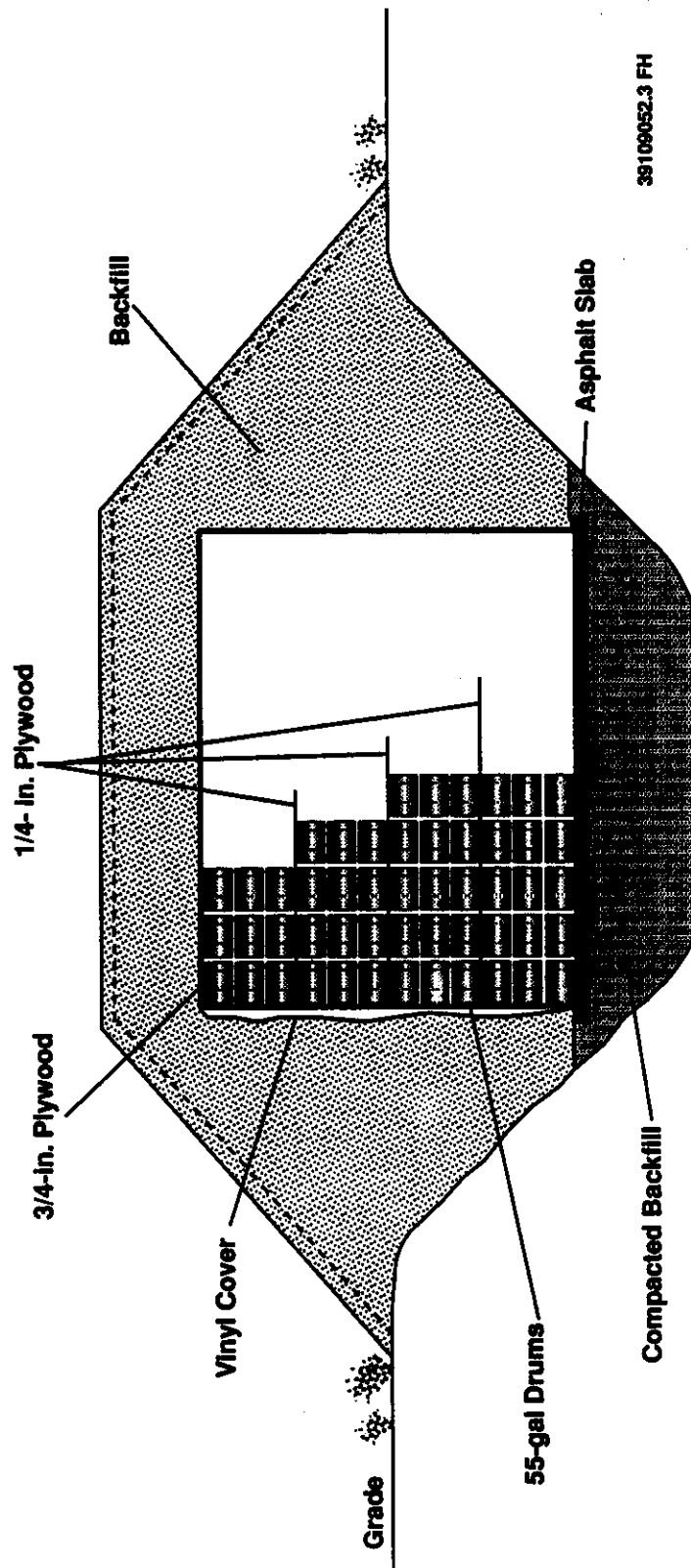
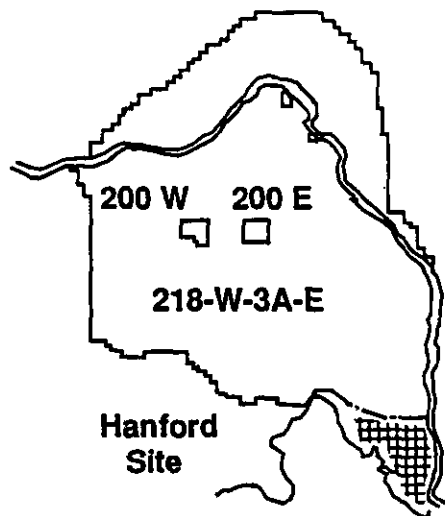
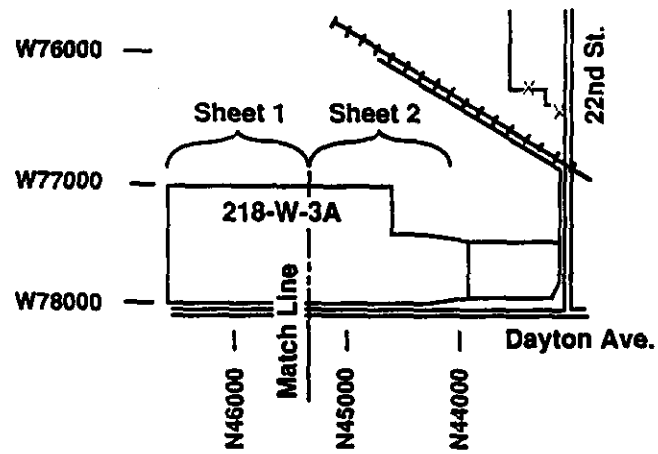


Figure 5-3. Burial Ground and Retrievable Storage Unit 218-W-3A.



**Burial Ground and Retrievable
Storage Unit
218-W-3A**

Updated January 1988

28901031.1M

Figure 5-4. Burial Ground 218-W-4B.

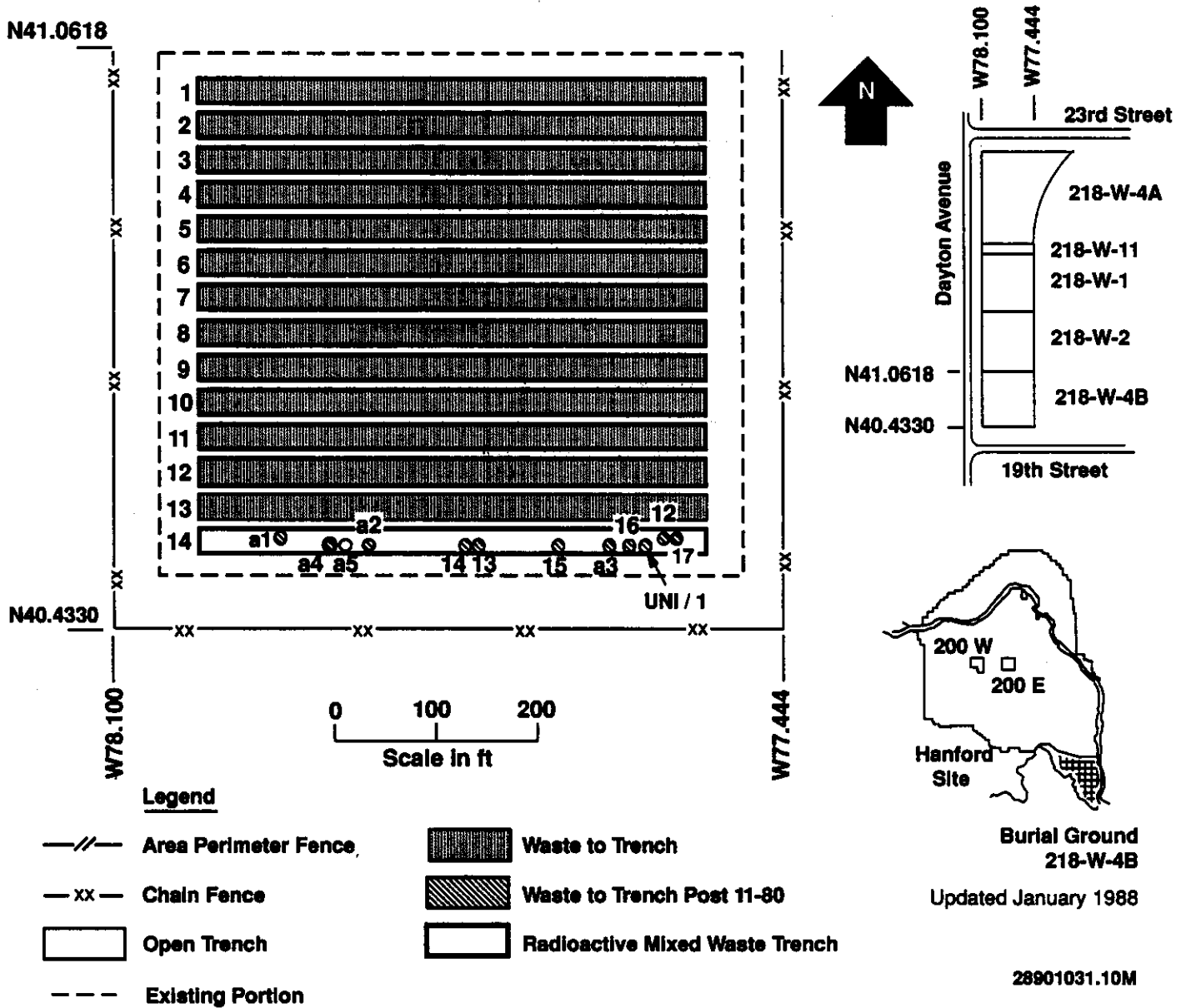


Figure 5-5. Burial Ground and Retrievable Storage Unit 218-W-4C.

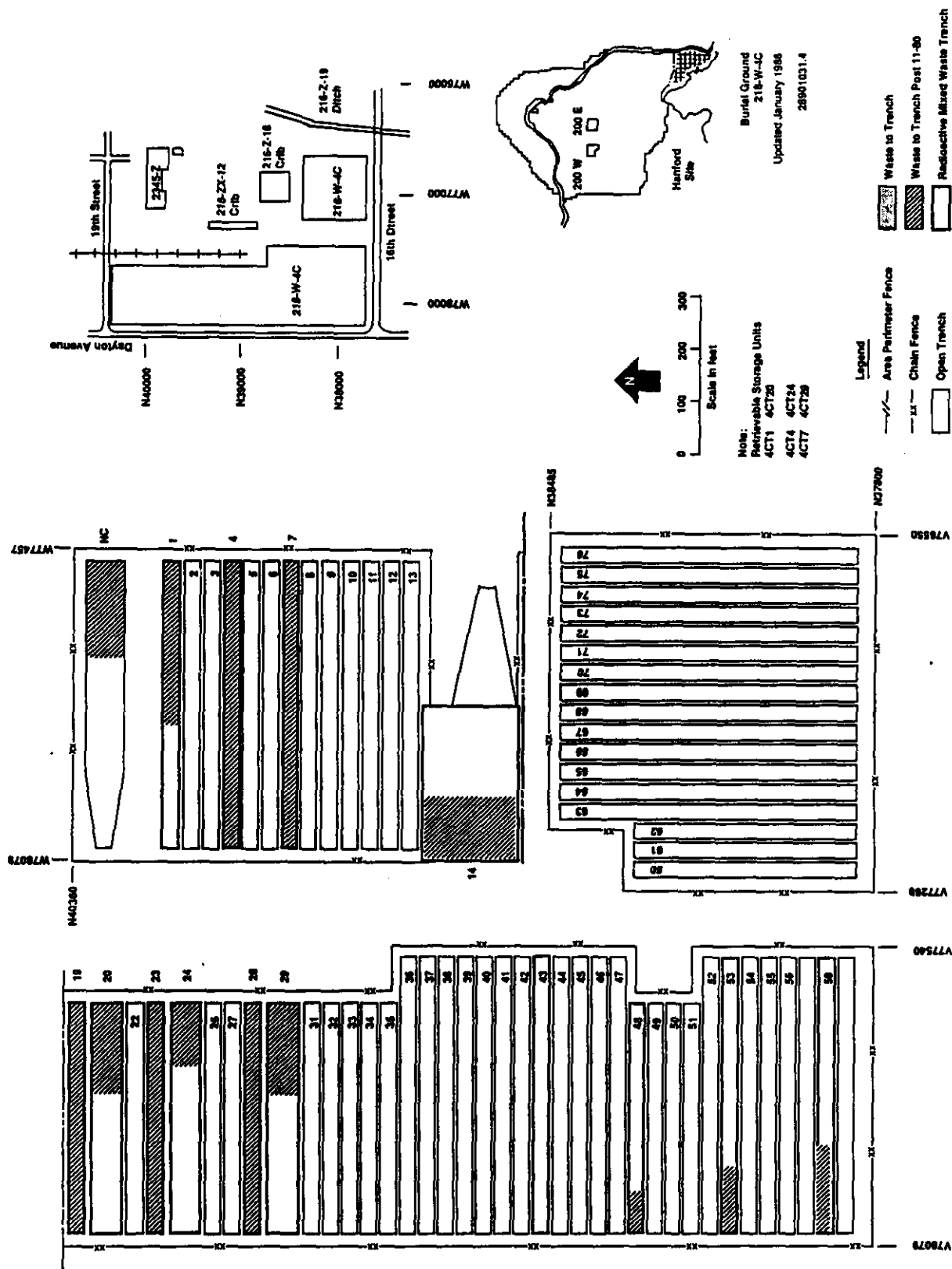


Figure 5-6. Burial Ground 218-E-12B.

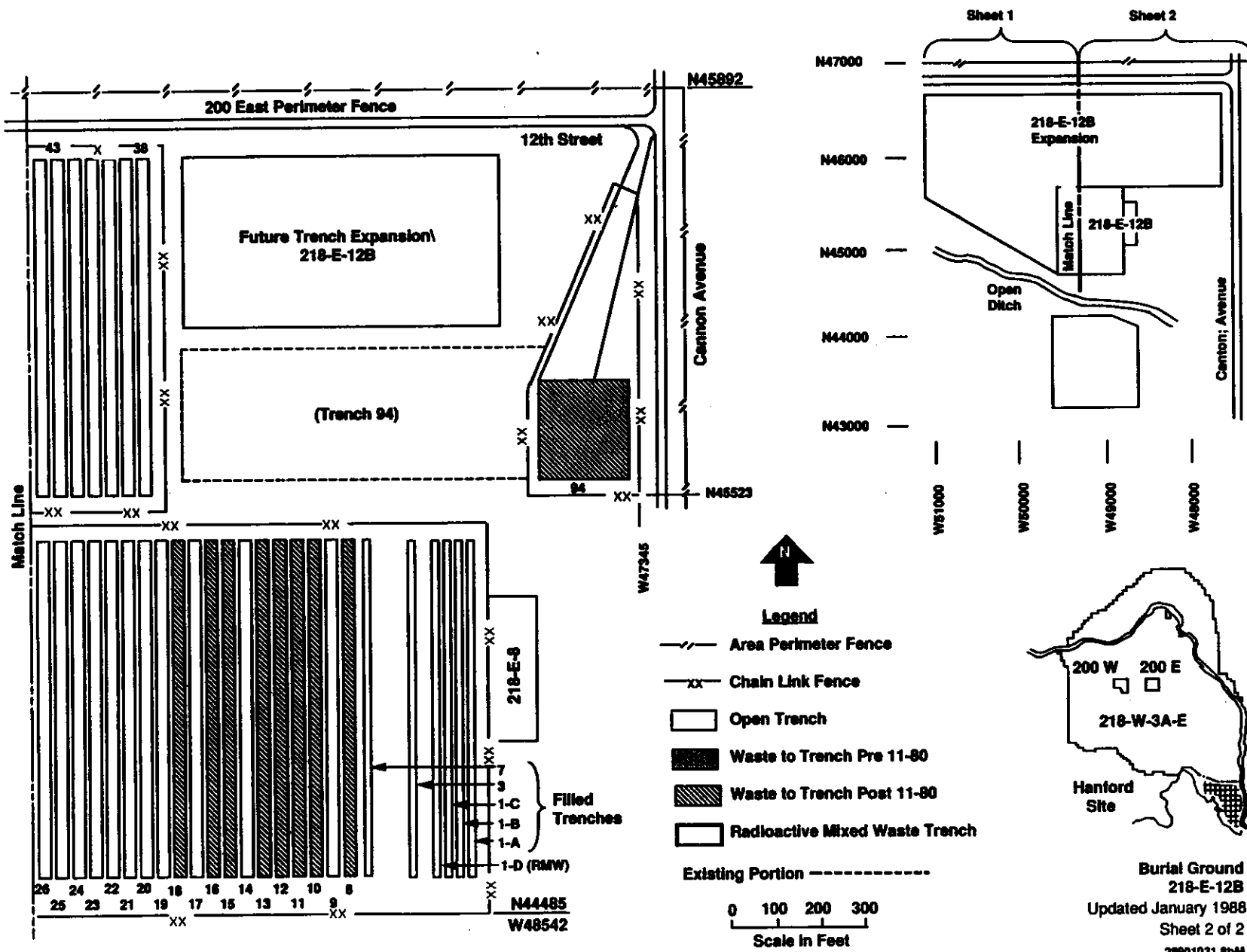


Figure 5-7. Typical Transuranic Waste Drum and Box Retrievable Storage--Burial Ground 4C, 200 West Area (8803743-5cn).

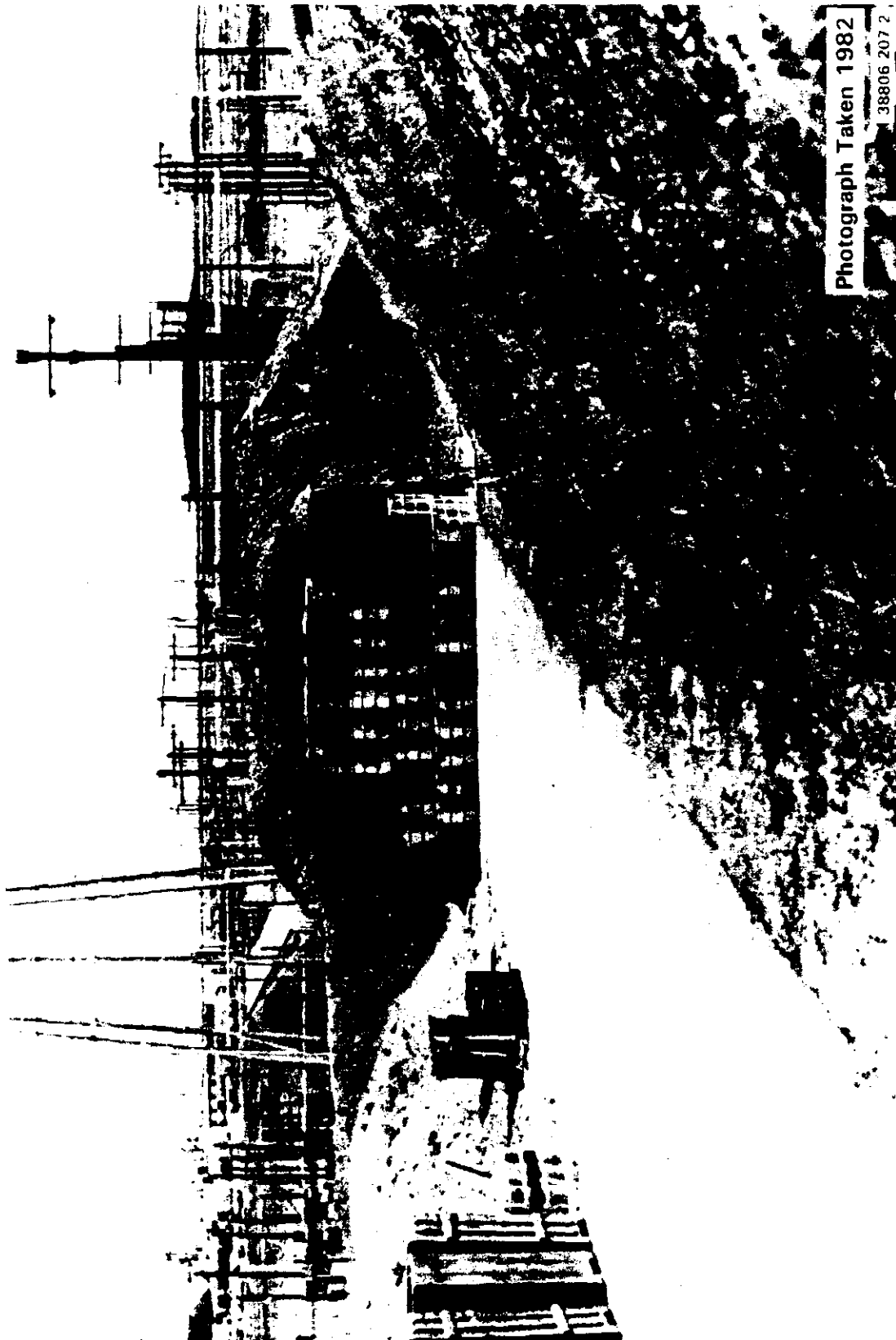


Figure 5-8. Typical Fiber Glass-Reinforced Polyester Box Storage on Earthen-Bottom Trench
Transuranic Waste Retrievable Storage--Burial Ground 3A,
Trench 17, 200 West Area (8803743-3cn).

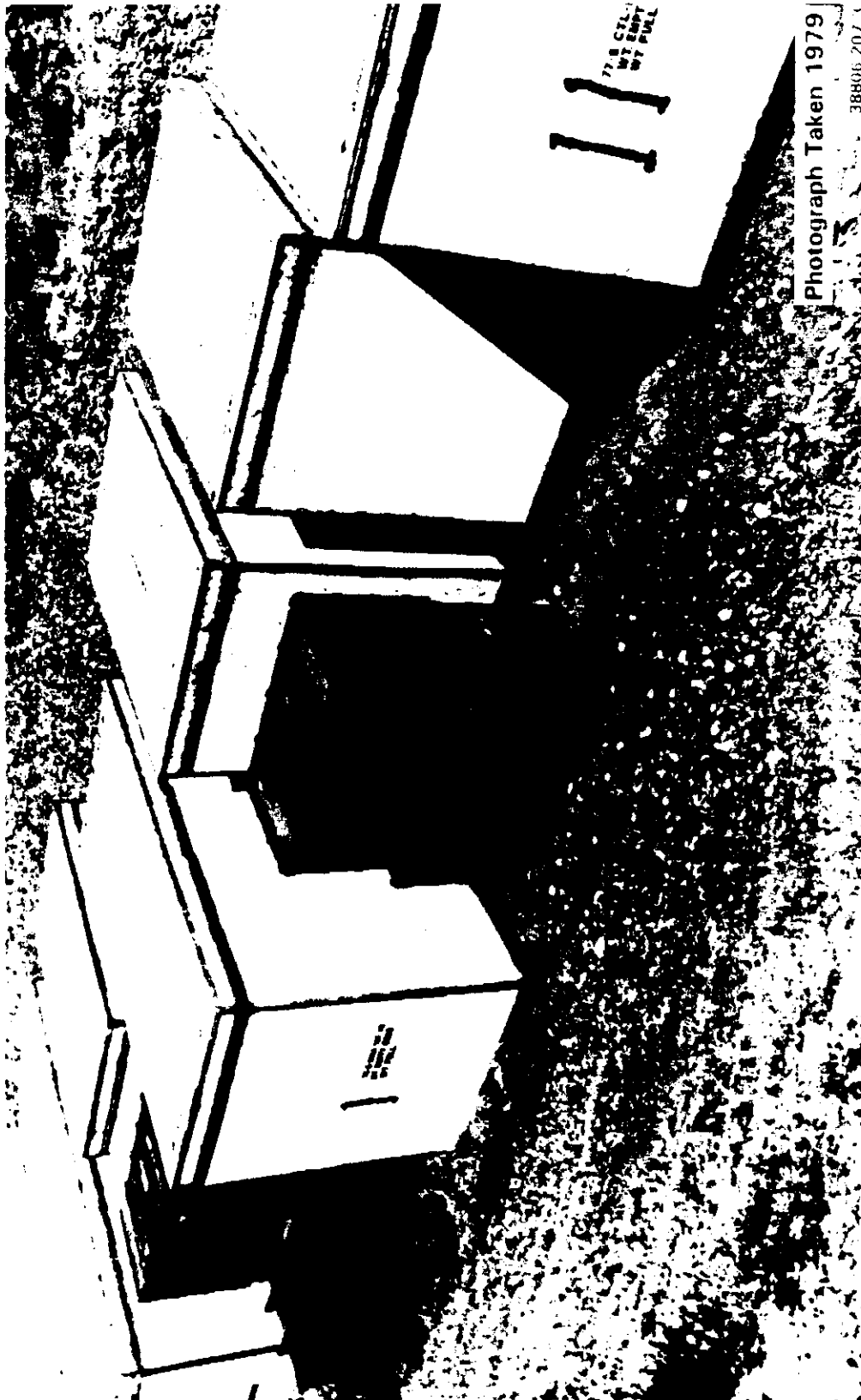
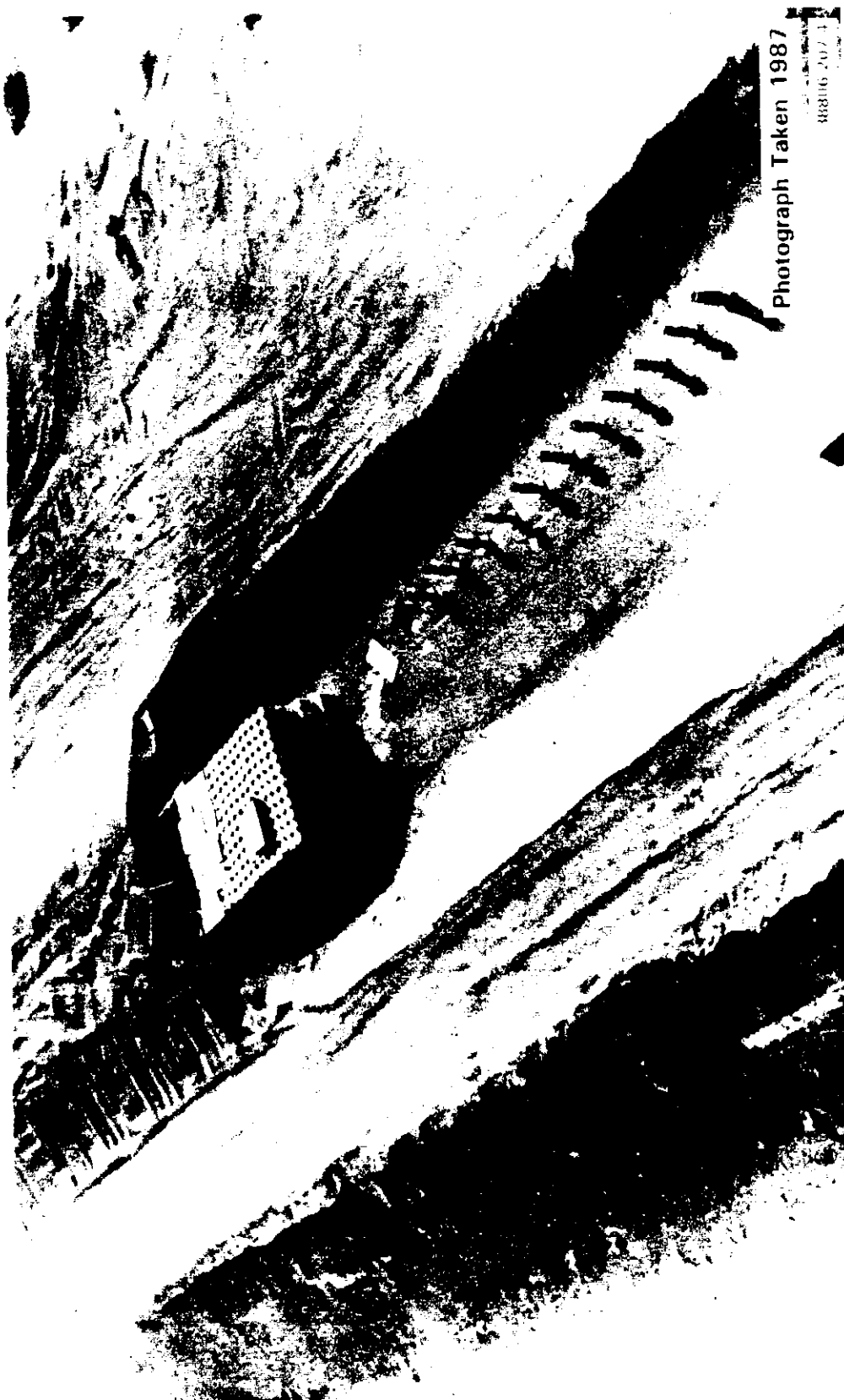


Figure 5-9. Typical Transuranic Waste Galvanized 55-gal Drum Retrievable Storage on Asphalt Pad--Burial Ground 4C, Trench T01, 200 West Area (8803743-4cn).



Photograph Taken 1987

8803743-4cn

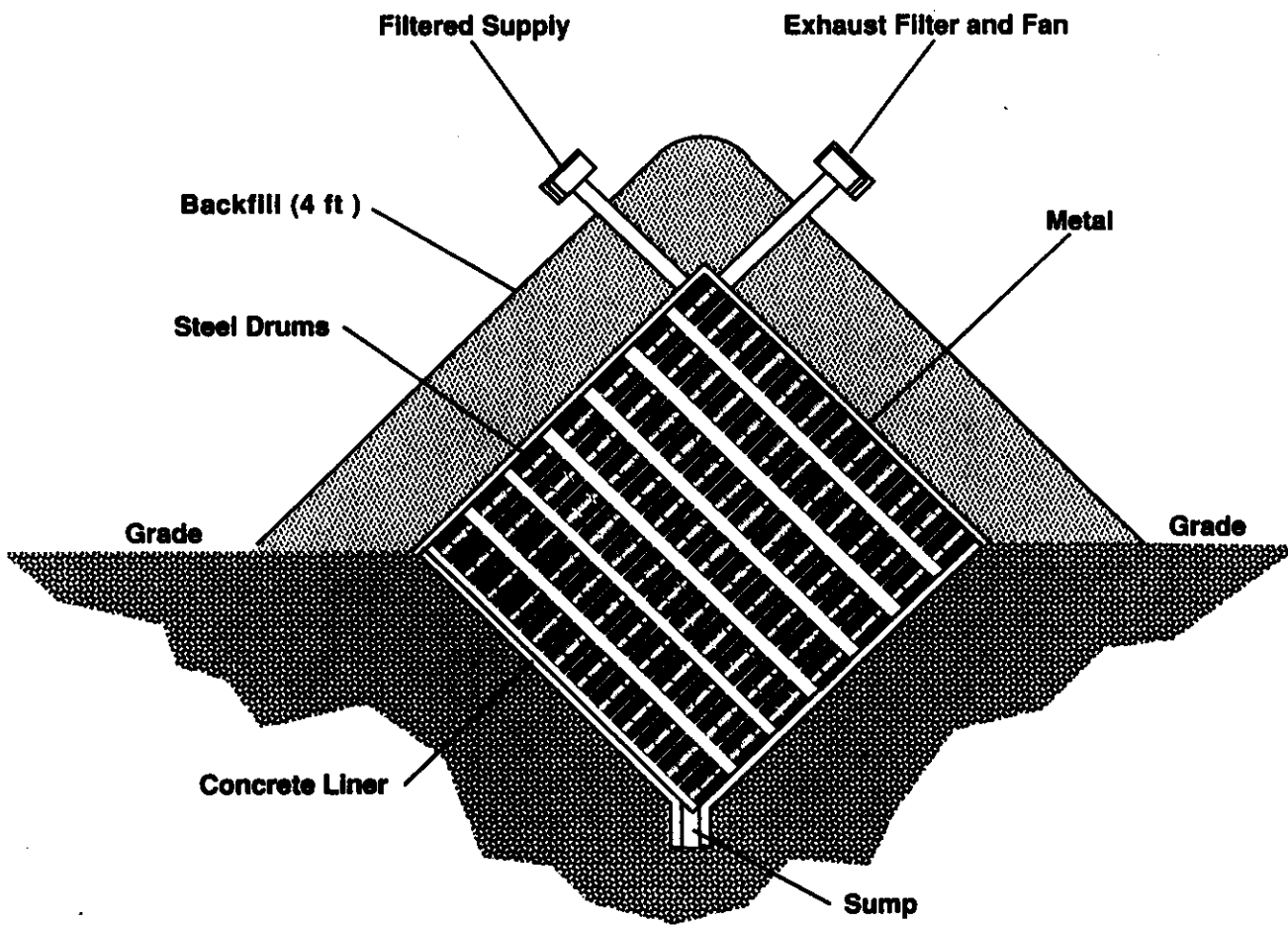
Figure 5-10. Typical Transuranic Waste Metal Box Retrievable Storage on Asphalt Pad--Burial Ground 4C, 200 West Area (8803743-1cn).



Figure 5-11. Approximately 6-in. Cut in Tarp, Created by Riser Installation (8701242-8cn).

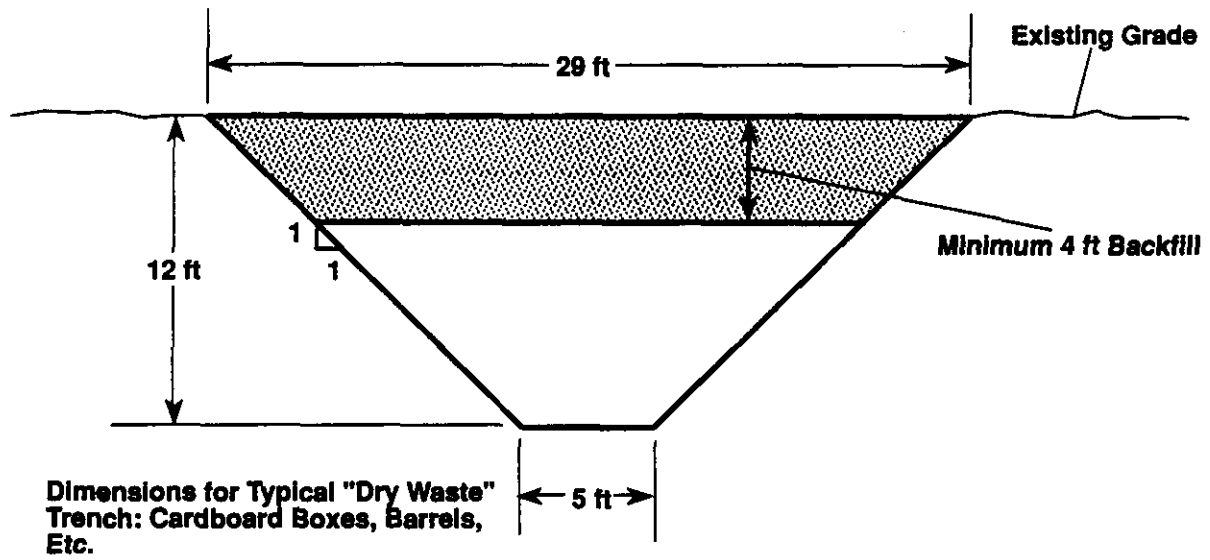


Figure 5-12. Concrete-Lined V Trench Used for Retrievable Transuranic Waste Storage.



39109052.1 FH

Figure 5-13. Solid Transuranic Waste Burial Trench.



39109052.2 FH

Table 5-1. Transuranic (TRU) Waste Containers per Facility and Unit (1970 to December 31, 1988). (Sheet 1 of 2)

Facility	Unit	110-gal drums	55-gal drums	30-gal drums	Plywood boxes	Concrete boxes	Fiber glass-reinforced polyester boxes	Metal boxes	Casks	Hanford standard cartons	Other	Total
SA ^c	SA	0	724	0	0	0	0	0	0	0	0	724
Subtotal		0	724	0	0	0	0	0	0	0	0	724
3A	TS6	0	0	0	0	0	0	0	6	0	0	6
	TS9	0	70	0	0	0	0	0	0	0	0	70
	T01	0	4	0	0	0	0	0	0	0	0	4
	T04	0	143	0	0	0	0	0	0	0	0	143
	T05	0	340	0	0	0	0	0	0	0	0	340
	T06	0	2,204	78	0	0	0	1	0	0	7	2,290
	T08	0	461	0	5	29 ^a	19	5	11	0	6	536
	T10	0	3	0	0	0	0	0	0	0	0	3
	T15	0	7	0	0	0	0	0	0	0	0	7
	T17	0	0	0	0	0	106	6	0	0	0	112
	T23	0	6	0	7	0	0	0	0	1	0	14
	T30	0	29	0	2	0	0	0	0	0	3	34
	T32	0	0	0	2	0	0	0	0	0	0	2
	T34	0	0	0	4	0	0	0	0	1	0	5
Subtotal		0	3,267	78	20	29	125	12	17	2	16	3,566
4B	TV7	0	1,335	3	0	0	0	0	0	0	0	1,338
	T07	35	7,991	2	1	3	1	38	0	0	25	8,096
	T11	1	3,100	7	1	26	5	58	0	0	19	3,217
Subtotal		36	12,426	12	2	29	6	96	0	0	44	12,651

Table 5-1. Transuranic (TRU) Waste Containers per Facility and Unit (1970 to December 31, 1988). (Sheet 2 of 2)

Facility	Unit	110-gal drums	55-gal drums	30-gal drums	Plywood boxes	Concrete boxes	Fiber glass-reinforced polyester boxes	Metal boxes	Casks	Hanford standard cartons	Other	Total
4C	T01	15	5,027	4	0	0	7	62	22 ^a	0	36	5,173
	T04	0	9,865	0	0	0	1	37	0	0	57	9,960
	T07	0	43 ^b	0	0	0	63	10	0	0	0	116
	T19	0	1	0	0	0	0	0	0	0	0	1
	T20	0	533	0	0	0	0	73	0	0	81	687
	T29	0	2,228	0	0	0	0	11	0	0	0	2,239
Subtotal		15	17,697	4	0	0	71	193	22	0	174	18,176
12B	T17	0	2,634	5	0	0	0	28	0	23	10	2,700
	T27	0	240	0	0	0	0	0	0	0	4	244
Subtotal		0	2,874	5	0	0	0	28	0	23	14	2,944
212N ^c	L01	0	0	0	15	0	0	0	0	0	0	15
Subtotal		0	0	0	15	0	0	0	0	0	0	15
212P ^c	L01	0	24	0	0	0	0	0	0	0	0	24
Subtotal		0	24	0	0	0	0	0	0	0	0	24
224T ^c	L01	0	72	0	0	0	0	0	0	0	0	72
	L02	0	496	0	0	0	0	0	0	0	0	496
	L03	0	51	0	0	0	0	0	0	0	0	51
Subtotal		0	619	0	0	0	0	0	0	0	0	619
2401W ^c	L01	0	10	0	0	0	0	0	0	0	0	10
Subtotal		0	10	0	0	0	0	0	0	0	0	10
Grand total		51	37,641	99	37	58	202	329	39	25	248	38,729

^aTwenty-two of these casks contain spent research-reactor fuel.^b13 of these contain spent research-reactor fuel.^cStaging Area.^dStorage Facilities.

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Table 5-2. Burial Ground and Trench--First and Last Time Used up to December 31, 1988. (Sheet 1 of 5)

200 Area	Burial ground location	Trench	Waste type and description	First disposal date	Last disposal date	Volume (ft ³)	MW present	Activity level ^c	
								TRU waste only	All wasted ^d
E	12B	T17	N = NON-TRU	10/09/73	04/16/74	23,435.23	Yes	N/A	N/A
E	12B	T17	T = TRANSURANIC	05/06/70	10/27/72	20,635.95	--	6.6 E + 01	3.1 E + 01
E	12B	T27	N = NON-TRU	04/02/71	04/05/72	53,404.43	--	N/A	N/A
E	12B	T27	T = TRANSURANIC	02/03/71	03/25/71	1,920.00	--	6.1 E + 01	2.0 E + 00
Wa	SA	SA	N = NON-TRU	08/30/80	11/04/88	1,901.82	Yes	N/A	N/A
Wa	SA	SA	NO = NON-TRU-offsite	09/24/88	12/21/88	5,153.30	Yes	N/A	N/A
Wa	SA	SA	TO = TRU-offsite	02/19/88	08/30/88	274.39	Yes	--	NA
Wa	SA	SA	6 = TRU-uncertified	04/03/86	12/30/88	2,595.61	Yes	1.4 E + 04	1.4 E + 04
Wa	SA	SA	60 = TRU-uncertified-offsite	08/05/86	11/03/87	2,499.19	Yes	--	--
W	03A	TS6	N = NON-TRU	08/04/87	10/30/87	638.80	Yes	N/A	N/A
W	03A	TS6	NO = NON-TRU-offsite	03/23/87	04/22/88	1,777.60	Yes	N/A	N/A
W	03A	TS6	TO-TRANSURANIC-offsite	09/29/87	09/29/87	20.13	Yes	6.4 E + 04	3.5 E + 03
W	03A	TS6	6 = TRU UNCERTIFIED	03/20/87	04/29/87	122.72	Yes	--	--
W	03A	TS9	N = NON-TRU	06/12/80	09/04/80	27,320.87	Yes	N/A	N/A
W	03A	TS9	NO = NON-TRU-offsite	08/21/80	08/21/80	320.00	--	N/A	N/A
W	03A	TS9	TO = TRANSURANIC-offsite	02/13/80	03/12/80	518.00	--	3.5 E + 02	6.0 E + 00
W	03A	T01	N = NON-TRU	01/26/73	02/13/73	4,003.20	--	N/A	N/A
W	03A	T01	T = TRANSURANIC	02/09/73	02/09/73	30.00	--	1.2 E + 01	9.0 E - 02

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Table 5-2. Burial Ground and Trench--First and Last Time Used up to December 31, 1988. (Sheet 2 of 5)

200 Area	Burial ground location	Trench	Waste type and description	First disposal date	Last disposal date	Volume (ft ³)	MW present	Activity level ^c	
								TRU waste only	All wasted
W	03A	T04	N = NON-TRU	10/07/74	01/10/75	35,410.17	Yes	N/A	N/A
W	03A	T04	NO = NON-TRU-offsite	11/15/74	11/22/74	587.50		N/A	N/A
W	03A	T04	TO = TRANSURANIC-offsite	10/23/74	10/24/74	1,058.19		1.0 E + 02	3.0 E + 00
W	03A	T05	N = NON-TRU	10/23/85	09/05/86	105.00	Yes	N/A	N/A
W	03A	T05	NO = NON-TRU-offsite	11/24/80	07/12/84	1,078.00	Yes	N/A	N/A
W	03A	T05	T = TRANSURANIC	07/03/84	07/03/84	7.40		3.2 E + 03	2.2 E + 03
W	03A	T05	TO = TRANSURANIC-offsite	08/07/80	08/27/84	2,516.20	Yes		
W	03A	T06	T = TRANSURANIC	05/08/70	05/07/71	17,337.11	Yes	1.8 E + 03	8.7 E + 02
W	03A	T06	UA = UNSEG NON-TRU DRY WASTE	02/27/70	04/30/70	18,029.19		N/A	N/A
W	03A	T08	N = NON-TRU	06/18/75	03/09/76	2,478.00		N/A	N/A
W	03A	T08	T = TRANSURANIC	08/23/74	04/04/79	9,834.98			
W	03A	T08	TO = TRANSURANIC-offsite	04/26/74	12/14/79	6,509.77		1.4 E + 03	9.7 E + 02
W	03A	T10	N = NON-TRU	02/16/73	10/05/76	31,513.46	Yes	N/A	N/A
W	03A	T10	T = TRANSURANIC	03/02/73	03/02/73	22.50		9.0 E + 00	6.0 E - 03
W	03A	T15	N = NON-TRU	07/25/72	01/26/73	34,359.43	Yes	N/A	N/A
W	03A	T15	NO = NON-TRU-offsite	11/03/72	11/03/72	680.80		N/A	N/A
W	03A	T15	T = TRANSURANIC	01/16/73	11/06/73	51.80		9.0 E + 00	1.0 E - 02
W	03A	T17	N = NON-TRU	11/05/83	11/05/83	1,680.00		N/A	N/A

Table 5-2. Burial Ground and Trench--First and Last Time Used up to December 31, 1988. (Sheet 3 of 5)

200 Area	Burial ground location	Trench	Waste type and description	First disposal date	Last disposal date	Volume (ft ³)	MW present	Activity level ^c	
								TRU waste only	All wasted ^d
W	03A	T17	T = TRANSURANIC	02/14/75	08/16/78	94,733.00	Yes	5.4 E + 02	5.3 E + 02
W	03A	T17	TO = TRANSURANIC-offsite	02/20/80	03/18/82	9,956.23			
W	03A	T23	N = NON-TRU	06/03/76	03/08/77	52,317.82	Yes	N/A	N/A
W	03A	T23	T = TRANSURANIC	06/10/76	11/24/76	496.90		4.9 E + 01	4.6 E - 01
W	03A	T30	N = NON-TRU	07/23/75	09/02/76	52,714.74		N/A	N/A
W	03A	T30	NO = NON-TRU-offsite	10/10/75	10/10/75	1,411.72	Yes	N/A	N/A
W	03A	T30	T = TRANSURANIC	10/28/75	09/02/76	1,246.60		1.2 E + 02	2.6 E + 00
W	03A	T32	N = NON-TRU	12/14/76	04/22/77	71,805.25	Yes	N/A	N/A
W	03A	T32	T = TRANSURANIC	01/03/77	01/03/77	128.00		1.0 E + 03	1.8 E + 00
W	03A	T34	N = NON-TRU	10/29/75	03/19/76	46,581.92	Yes	N/A	N/A
W	03A	T34	T = TRANSURANIC	02/20/76	03/15/76	308.50		1.8 E + 01	1.0 E - 02
W	04B	TV7	T = TRANSURANIC	01/13/72	03/30/73	9,743.21	YES	2.9 E + 03	2.9 E + 03
W	04B	TV7	TO = TRANSURANIC-offsite	11/03/72	11/03/72	155.40			
W	04B	T07	N = NON-TRU	09/23/81	09/23/81	540.80		N/A	N/A
W	04B	T07	NO = NON-TRU-offsite	11/30/80	04/13/83	46.40		N/A	N/A
W	04B	T07	T = TRANSURANIC	08/13/73	09/27/78	66,795.25	Yes	5.5 E + 03	5.5 E + 03
W	04B	T07	TO = TRANSURANIC-offsite	10/16/73	08/12/76	799.20			
W	04B	T11	T = TRANSURANIC	08/04/70	01/19/78	35,956.27	Yes	1.2 E + 03	1.2 E + 03

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Table 5-2. Burial Ground and Trench--First and Last Time Used up to December 31, 1988. (Sheet 4 of 5)

200 Area	Burial ground location	Trench	Waste type and description	First disposal date	Last disposal date	Volume (ft ³)	MW present	Activity level ^c	
								TRU waste only	All wasted ^d
W	04B	T11	TO=TRANSURANIC-offsite	06/30/72	06/30/72	14.80			
W	04C	T01	T=TRANSURANIC	03/14/78	01/28/85	15,751.39	Yes	4.4 E + 04	4.4 E + 04
W	04C	T01	TO=TRANSURANIC-offsite	12/10/79	05/16/84	14,777.70	Yes		
W	04C	T01	6=TRU UNCERTIFIED	07/07/83	03/26/87	25,924.66	Yes		
W	04C	T01	6O=TRU uncertified-offsite	11/10/82	11/10/82	346.00			
W	04C	T04	T=TRANSURANIC	04/24/78	09/25/84	69,359.63	Yes	1.2 E + 04	1.2 E + 04
W	04C	T04	TO=TRANSURANIC-offsite	10/29/78	06/30/84	15,041.07	Yes		
W	04C	T04	6=TRU UNCERTIFIED	08/27/84	10/29/84	244.62			
W	04C	T07	NO=NON-TRU-offsite	11/29/83	01/30/84	274.90	Yes	N/A	N/A
W	04C	T07	T=TRANSURANIC	11/17/80	05/21/85	57,063.57	Yes	2.0 E + 03	
W	04C	T07	TO=TRANSURANIC-offsite	03/23/82	12/09/83	9,840.80	Yes		
W	04C	T07	6=TRU UNCERTIFIED	08/20/85	03/18/87	1127.59	Yes		
W	04C	T19	N=NON-TRU	09/02/81	10/08/81	30,645.91	Yes	N/A	N/A
W	04C	T19	NO=NON-TRU-offsite	09/03/81	10/08/81	10,502.50	Yes	N/A	N/A
W	04C	T19	TO=TRANSURANIC-offsite	10/08/81	10/08/81	7.50		9.0 E - 02	1.6 E - 05
W	04C	T20	T=TRANSURANIC	12/01/82	08/07/84	2,464.99	Yes	1.4 E + 04	1.4 E + 04
W	04C	T20	TO=TRANSURANIC-offsite	10/03/80	02/14/84	12,926.10	Yes		
W	04C	T20	6=TRU UNCERTIFIED	08/25/83	03/07/85	469.40			

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Table 5-2. Burial Ground and Trench--First and Last Time Used up to December 31, 1988. (Sheet 5 of 5)

200 Area	Burial ground location	Trench	Waste type and description	First disposal date	Last disposal date	Volume (ft ³)	MW present	Activity level ^c	
								TRU waste only	All wasted ^d
W	04C	T20	60 = TRU UNCERTIFIED-offsite	12/18/80	11/23/83	1,684.80			
W	04C	T29	T = TRANSURANIC	09/27/85	09/27/85	249.48			
W	04C	T29	6 = TRU UNCERTIFIED	09/28/83	05/23/88	9,932.53	Yes	1.5 E + 04	1.5 E + 04
W	04C	T29	60 = TRU UNCERTIFIED-offsite	09/08/83	11/25/87	8,515.88	Yes		
W ^b	212N ^e	L01	T = TRANSURANIC	05/30/70	05/30/70	7,651.00		1.7 E + 02	1.7 E + 02
W ^b	212P ^e	L01	T = TRANSURANIC	08/25/82	05/01/85	177.82	Yes	8.7 E + 02	8.7 E + 02
W ^b	224T ^e	L01	T = TRANSURANIC	06/13/86	06/13/86	14.83		4.6 E + 04	4.6 E + 04
W ^b	224T ^e	L01	6 = TRU UNCERTIFIED	01/26/87	12/27/88	563.65			
W ^b	224T ^e	L02	4 = TRU CERTIFIED	02/10/86	11/29/88	3,678.35	Yes	3.5 E + 04	3.5 E + 04
W ^b	224T ^e	L03	4 = TRU CERTIFIED	05/29/86	06/01/88	378.22	Yes	1.0 E + 05	1.0 E + 05
W ^b	2401W ^e	L01	N = NON-TRU	08/02/88	10/28/88	1,369.00	Yes	N/A	N/A
W ^b	2401W	L01	6 = TRU UNCERTIFIED	12/15/88	12/15/88	74.16	Yes	3.4 E + 02	3.4 E + 02

^aStaging Area.^bStorage Facilities.^cActivity is in nCi/g of waste. Great than 100 nCi/g is TRU Waste and below is Low Level.^dActivity in total trench assumes that LLW has the same density as the TRU Waste. The container weight is also assumed to be part of the waste.^eAcronyms used in R-SWIMS to designate storage facilities. 224T is TRUSAF.

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Figure 5-14. Quantity, Years of Emplacement, and Trench
Placement of Retrievably stored Wastes
(May 1970 to December 31, 1988).

200 Area	Burial ground	Trench number	Quantity		Year last waste emplaced	Years of transuranic waste emplacement					
			55-gal drums	Boxes/ other		1970	1973	1975	1980	1985	January 1989
									----- Drums stored vertically-----		
West	03A	TS6		6	1987						
West	03A	TS9	70		1980						
West	03A	T01	4		1973						
West	03A	T04	143		1974						
West	03A	T05	340		1984						
West	03A	T06	2,204	86	1971						
West	03A	T08	461	75	1979						
West	03A	T10	3		1973						
West	03A	T15	7		1973						
West	03A	T17		112	1982						
West	03A	T23	6	8	1976						
West	03A	T30	29	5	1976						
West	03A	T32		2	1977						
West	03A	T34		5	1976						
West	04B	TV7	1,335	3	1973						
West	04B	T07	7,991	105	1978						
West	04B	T11	3,100	117	1978						
West	04C	T01	5,027	146	1987						
West	04C	T04	9,865	95	1984						
West	04C	T07	43	73	1987						
West	04C	T19	1		1981						
West	04C	T20	533	154	1985						
West	04C	T29	2,228	11	1988						
East	12B	T17	2,634	66	1973						
East	12B	T27	240	4	1972						
West	212N	L01		15	1970						
West	212P	L01	24		1985						
West	224T	L01	72		1986						
West	224T	L02	496		1988						
West	224T	L03	51		1988						
West	2401W	L01	10		1988						
West	SA	SA	724		1988						
			Total = 37,641	Total = 1,088							

Table 5-3. Transuranic (TRU) Waste, Curie, Weight, and Volume Data by Burial Ground and Trench (1970 to 1987).

Facility	Unit	Total number of containers	Total TRU (g)	Total alpha (Ci)	Total container weight (lb)	Total container volume (ft ³)
SA ^a	SA	724	1.876 E+04	1.547 E+03	2.402 E+05	5.369 E+03
Subtotal		724	1.876 E+04	1.547 E+03	2.402 E+05	5.369 E+03
03A	TS6	6	9.811 E+03	8.193 E+02	2.841 E+04	1.428 E+02
	TS9	70	2.682 E+01	2.239 E+00	1.403 E+04	5.180 E+02
	T01	4	4.000 E-02	3.340 E-03	6.000 E+02	3.000 E+01
	T04	143	2.161 E+01	1.805 E+00	3.920 E+04	1.058 E+03
	T05	340	1.202 E+03	9.853 E+01	6.776 E+04	2.584 E+03
	T06	2,290	3.453 E+03	2.868 E+02	3.564 E+05	1.734 E+04
	T08	536	7.247 E+03	6.049 E+02	9.804 E+05	1.634 E+04
	T10	3	3.000 E-02	2.505 E-03	6.210 E+02	2.250 E+01
	T15	7	7.000 E-02	5.845 E-03	1.449 E+03	5.180 E+01
	T17	112	7.081 E+03	5.913 E+02	2.414 E+06	1.047 E+05
	T23	14	3.595 E+00	3.002 E-01	1.359 E+04	4.969 E+02
	T30	34	2.137 E+01	1.784 E+00	3.366 E+04	1.247 E+03
	T32	2	1.950 E+00	1.628 E-01	3.584 E+02	1.280 E+02
	T34	5	8.320 E-01	6.948 E-02	8.540 E+03	3.085 E+02
Subtotal		3,566	2.887 E+04	2.407 E+03	3.959 E+06	1.449 E+05
04B	TV7	1,338	3.152 E+03	2.632 E+02	2.012 E+05	9.899 E+03
	T07	8,096	5.003 E+04	3.627 E+03	1.450 E+06	6.759 E+04
	T11	3,217	6.225 E+03	5.183 E+02	9.815 E+05	3.597 E+04
Subtotal		12,651	5.941 E+04	4.408 E+03	2.633 E+06	1.135 E+05
04C	T01	5,161	1.390 E+05	1.172 E+04	1.376 E+06	5.671 E+04
04C ^c	T01	12	5.230 E+03	1.583 E+04	1.800 E+03	8.880 E+01
04C	T04	9,960	1.072 E+05	8.993 E+03	1.707 E+06	8.464 E+04
04C	T07	116	8.644 E+03	7.218 E+02	7.932 E+05	6.803 E+04
	T19	1	1.501 E-01	8.350 E-06	2.000 E+02	7.500 E+00
	T20	687	4.076 E+04	3.393 E+03	5.289 E+05	1.755 E+04
	T29	2,239	5.688 E+04	4.772 E+03	7.123 E+05	1.870 E+04
Subtotal		18,176	3.577 E+05	4.543 E+04	5.120 E+06	2.457 E+05
12B	T17	2,700	1.523 E+02	1.272 E+01	4.228 E+05	2.064 E+04
	T27	244	1.345 E+01	1.123 E+00	4.003 E+04	1.920 E+03
Subtotal		2,944	1.657 E+02	1.384 E+01	4.628 E+05	2.256 E+04
212 ^b	L01	15	4.380 E+01	2.097 E+01	2.754 E+05	7.651 E+03
Subtotal		15	4.380 E+01	2.097 E+01	2.754 E+05	7.651 E+03
212P ^b	L01	24	2.200 E+01	1.837 E+00	4.678 E+03	1.778 E+02
Subtotal		24	2.200 E+01	1.837 E+00	4.678 E+03	1.778 E+02
224T ^b	L01	72	3.055 E+03	2.550 E+02	1.220 E+04	5.785 E+02
224T ^b	L02	496	1.292 E+04	1.078 E+03	6.873 E+04	3.678 E+03
224T ^b	L03	51	4.148 E+03	3.464 E+02	7.584 E+03	3.782 E+02
Subtotal		619	2.012 E+04	1.680 E+03	8.851 E+04	4.635 E+03
2401W ^b	L01	10	2.809 E+00	2.346 E-01	1.543E+03	7.416E+01
Subtotal		10	2.809 E+00	2.346 E-01	1.543E+03	7.416E+01
Grand total		38,729	4.851 E+05	5.551 E+04	1.278 E+07	5.445 E+05

^aStaging area.^bStorage facilities.^c12 drums of high ²³⁸Pu content stored in Facility 04C, Unit T01, are listed separately for information purposes.

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6.0 CONTAINER INTEGRITY

The ease of retrievability of stored TRU waste containers is dependent on their integrity. Breached containers would increase the possibility of contamination within the retrieval area and outside it, and thus increase the time and expense to control radiological aspects during retrieval operations. Containers with reduced structural integrity could not be moved without risk of spilling their contents, necessitating repackaging at the retrieval site, again increasing time and expense of retrieval. Retrieval of stored TRU waste requires an estimation of container integrity (provided in this section) as a function of time and storage environment.

This section presents a summary of container examinations and corrosion analyses performed at the INEL, the Savannah River Plant (SRP), and the Hanford Site. These studies represent the best available information for prediction of container life, as they are prototypical of the actual material and environment. Predicting corrosion behavior from coupon tests and environments different from in-service environments is always difficult because of the strong dependency of corrosion processes on the local environment. Additionally, soil and atmospheric corrosion based on theoretical background will be given to augment observations and conclusions.

The types and numbers of containers in question at the Hanford Site were discussed previously in this document. The emphasis in this section is on drums, as they present approximately half of the total stored volume and are the most numerous type of container. Information also is presented on the condition of FRP containers in storage at the INEL.

6.1 CORROSION BACKGROUND

Some general considerations regarding expected corrosion effects on buried drums will be provided before examining the details of actual investigations.

While all corrosion is principally electrochemical in nature, it can take many forms. Normally, corrosion is categorized by its physical appearance. The dominant types of corrosion expected in buried TRU waste containers would be general corrosion and pitting corrosion. General corrosion is material removal that proceeds approximately uniformly over the material surface. Pitting corrosion occurs in small localized areas but is accelerated relative to general corrosion rates by environmental factors, i.e., certain ionic species or surface effects such as nonprotective scale. Pitting and general corrosion often occur in the same location with through-wall pits at the bottom of deepest areas of general corrosion. Conditions should not be favorable for other forms of corrosion, such as stress corrosion cracking.

The storage practices at the Hanford Site and other DOE sites result in a division of container environments, for purposes of corrosion estimation, into two general categories: (1) direct soil coverage, and (2) storage under plastic covering. Direct contact with the soil will result in the highest corrosion rates. High-integrity plastic covering will reduce moisture and soil contact and simulate a humid atmospheric environment. In many cases, the plastic coverings have been damaged or not sealed well (at vent pipes, for instance). The type of environment at such locations will depend on the extent of the break in the covering, but it is most probable that the environment would resemble direct soil burial for the affected containers. Thus, for purposes of corrosion forecasting, the drums experiencing direct soil contact would include those so buried plus some fraction of containers at breaks in plastic covers. Additionally, the humidity within a storage area under plastic will cause accelerated corrosion where containers contact moist plastic directly or where containers sit in pooled moisture.

6.2 CONTAINER RETRIEVAL INVESTIGATIONS AT THE IDAHO NATIONAL ENGINEERING LABORATORY

Four programs of waste retrieval investigations at the INEL have been carried out: early waste retrieval (Bishoff and Hudson 1979), initial drum retrieval (McKinley and McKinney 1978 and Card and Wang 1977), and two transuranic storage area (TSA) cell inspection programs (Bishoff 1979a).

The Early Waste Retrieval Program is of interest to this investigation as it had nearly identical goals and waste container types. Thus the techniques and results are a preview of what might be expected during such activities at the Hanford Site. The progress of corrosion found on retrieved containers is also of interest as it should be roughly comparable to corrosion expected in Hanford Site soil, assuming similar burial configurations. This is a consequence of similar soil properties important to corrosion: resistivity, chloride content, pH, and moisture content.

The Early Waste Retrieval Program, conducted during 1978, examined drums, cardboard boxes, and plywood boxes in trenches operated between 1957 and 1959 (18 to 21 yr of direct soil burial). Reportedly, 65% of 137 drums were breached and "several" fell apart during retrieval. Wooden boxes were deteriorated and stacked drums were in better condition than those randomly stored. Stacking of drums may result in less corrosion of some drums because of less direct exposure to soil and moisture. A total volume of 2,000 m³ was retrieved during this program with all operations conducted under a full-containment environment. All personnel wore bubble suits. The air from the retrieval facilities was processed through high-efficiency particulate air (HEPA) filters. All waste material was transferred through airlocks, under strict radiological control procedures.

The Initial Drum Retrieval Program resulted in the retrieval of 20,262 drums from the Radioactive Waste Management Complex. These drums were stacked horizontally and directly buried in soil between 1968 and 1970 in pits 11 and 12. The retrieval operations were performed between 1974 and 1978. The drums were buried for 4 to 10 yr and were procured to U.S. Department of Transportation (DOT) 17C or 17H specifications. Specifications and exteriors were painted. These operations were conducted inside an air-support facility, and personnel wore shoe covers and coveralls. Respiratory protection was not required. It was concluded that 2.4% of the drums from the Initial Drum Retrieval Program were breached with small holes; corrosion is the primary inferred cause of the small holes. The drums were placed in plastic bags for subsequent handling (McKinley and McKinney 1978). The reports did not indicate that radiological control problems were encountered; hence, the structural integrity was maintained, but with some reduced safety margin.

In 1977, some other pits, operated during 1954 to 1968, were also examined during the Initial Drum Retrieval Program. These were pits 6, 9, and 10. The drums were in "fair" condition in pit 6 while the plywood boxes were in "extremely poor" condition. The retrieval of drums could not be performed because of their close proximity to the deteriorated boxed waste. In pits 9 and 10, 50% of the drums had "obvious corrosion holes" while the plywood crumbled when touched. The specific time of burial was not clear, but a total span of 9 to 23 yr is indicated. It is inferred that the structural integrity of drums in pits 9 and 10 were suspect. Retrieval of this waste was not conducted as part of the Initial Drum Retrieval Program because of the deteriorated condition of the containers (Card and Wang 1977).

In 1978, the TSA Inspection Program was carried out. The TSA came into being in 1970 responding to the AEC directive for retrievable TRU waste storage. It consisted of above-ground storage on asphalt pads using steel drums, steel boxes, plywood boxes, and fiber glass-coated plywood boxes. The containers were covered with plywood sheets, which in turn were covered with plastic covering and 2 ft of soil.

Thirty-two drums were retrieved from TSA cell 6, which was operated during 1973. It contained drums stacked vertically and also fiber glass-coated plywood boxes. The drums had an alkalized paint coating. The drums were in good condition but had some rust on the lids. The fiber glass boxes showed no signs of deterioration. Seventy drums were retrieved from TSA cell 1, opened in 1970 and closed in 1971. Drums, stored horizontally, were coated with bituminous paint. Plywood boxes were also stored in cell 1. Two of the drums showed "serious corrosion" but were not breached. Condition of the plywood boxes in cell 1 was very good based on visual inspection (Bishoff 1979a).

In 1979, additional penetrations of TSA pads 1 and 2 storage cells were conducted. The TSA pad 1 had eight cells and TSA pad 2 had one cell. Ten drums were retrieved from each cell. All drums appeared to be in good condition except for cell 5. During the covering of cell 5, the plywood was placed between the plastic cover and the soil. The plywood had deteriorated, and the plastic cover was torn. These holes permitted moisture to enter this cell. Consequently, the drums in cell 5 showed more deterioration than the containers in other cells. Subsequent to this report, the INEL has retrieved half of the waste from cell 5. A small quantity (5% to 10%) of these drums had been breached in local areas. A few FRP boxes had been breached; however, this intrusion was attributed to handling during initial coverage in the cells. No environmental or significant radiological problems were encountered (Bishoff 1979a).

During the retrieval of drums from TSA pad 1 and pad 2 cells, it was noted that the drums stored adjacent to vent pipes had more indications of rust than the other cells. It was concluded that the seal around the vent pipe may have served as a source for moisture entry. This situation would explain the reason for the increased rusting conditions in these areas.

The inspection of waste in the Transuranic Disposal Area (TDA) was also conducted in 1979. The purpose of this inspection was to determine if nitrate migration was occurring and to determine the condition of the containers. The waste had been placed on the pad starting in 1971 or 1972. The drums had been stacked horizontally with a plastic cover before soil coverage. The drums showed some indications of rusting but were considered to be in good condition. Deterioration of the plywood boxes had advanced to the point where this waste could not be retrieved without a containment facility over the disposal area.

6.3 DRUM INVESTIGATIONS AT THE SAVANNAH RIVER PLANT

Results of container retrieval at the SRP are pertinent as they represent the only data on galvanized waste-container corrosion in soil. The results will not be directly applicable to corrosion in Hanford Site soils, as the greater amount of soil moisture at the SRP would lead to higher corrosion rates. However, the SRP results could be viewed as a conservative upper bounding limit.

In 1977, 64 DOT 17C galvanized drums were placed in three soil mounds near the burial ground at SRP. The drums were placed on concrete pads stacked two high and were then covered with soil. A waterproof tarpaulin was placed over the soil-covered drums, and 2 ft of soil was placed on the tarpaulin. Drums were removed from 1978 to 1985. After more than 8 yr of exposure, the maximum depth of penetration was 17.28 mils, including penetration of 3.5 mils of galvanizing. The interim examinations revealed that the zinc coating had been penetrated after 4 1/2 yr. After one more year of exposure (5 1/2 yr total) the maximum penetration (on different drums) included nearly 8 mils of steel in addition to the galvanizing. Another 2 yr, 10 mo of exposure resulted in maximum penetration nearly 6 mils greater, for a total of 17.28 mils. Apparently the rate of steel corrosion was

decelerating with time, which would be the expected result for carbon steel. Pitting was observed on many containers, generally on the top and on areas contacting the soil.

6.4 DRUM INVESTIGATIONS AT THE HANFORD SITE

Segregated storage started at the Hanford Site in 1970. In 1972, concrete-lined V trenches were used and designated as retrievable storage. This method proved too expensive and in 1973 flat-bottomed, asphalt-pad storage began. Drums were stacked vertically with a plastic "pool cover" topped with plywood on the drums. At least 4 ft of soil was placed over the plastic and plywood.

An evaluation of soil corrosion on pipelines and underground structures was performed in 1955. Since then, no systematic evaluations of soil or atmospheric corrosion of metallic structures has been performed, with the exception of examinations of in situ drum conditions in the 218-W-4C T1 and in the 218-W-4B T7 trenches.

The 1955 report reviewed the expected corrosivity of Hanford Site soils as well as the condition of buried steel structures. The Hanford Site soils were compared to National Bureau of Standards soil surveys. The Hanford Site soils were placed in the class of soils with a fairly low corrosion potential, based on resistivity and acidity. It is interesting to note that the INEL soils are roughly comparable as far as corrosion potential. These classifications were verified by later publications on underground corrosion (Miller et al. 1981). However, there is a wide latitude for variability in corrosion rates within a corrosion potential class.

The corrosion examinations performed in 1955 were for a variety of piping materials including uncoated carbon steel and galvanized steel. The estimated average corrosion rates for 14 carbon steel lines were 5 mils/yr for general corrosion and 12 mils/yr for pitting. The environment and corrosion attack for each case was not well defined and, thus, may not be comparable exactly to storage conditions for drums, especially in the case of pitting, which is particularly sensitive to local conditions. Additionally, the steel in the examinations performed in 1955 apparently was mostly uncoated, while the Hanford TRU waste drums were at least painted, which would provide some corrosion retardation.

In 1981, another estimate of soil corrosion at the Hanford Site was performed. Based reportedly on measurements and observations of steel pipes and drums retrieved from the Hanford Site soil, a corrosion rate of 5 mils/yr for uncoated or ungalvanized steel was predicted.

The above estimates are reasonable but may be somewhat conservative for stacked, painted drums. Also, a single rate is not an accurate picture of the variable nature of corrosion. A best estimate of the range of expected corrosion of painted drums in soil, for initial drum penetration, is estimated to be 5 mils/yr \pm 50%, or 2.5 to 7.5 mils/yr. This rate would lead to initial penetration of DOT 17H drums (18 gauge or 0.050 in. steel-wall thickness) in approximately 7 to 20 yr. Thicker DOT 17C drums (16 gauge or 0.062 in. steel-wall thickness) would be penetrated in approximately 8 to 25 yr.

An inspection of drum integrity for asphalt-pad storage was carried out in 1982 with visual and ultrasonic techniques for drums stored for 8 1/2 yr. The maximum measured corrosion corresponded to a rate of approximately 1 mil/yr, at the interface with the nylon-reinforced plastic tarp. No penetration was noted. "Moderate to heavy" rust was observed on all surfaces in contact with the plastic tarp, with "heavy surface corrosion" on a specific drum that was exposed to soil through the torn plastic tarp.

From visual observation, the drums on the interior of the stack were corroded less than those on the outside. Drums at the bottom of the stack were more corroded than those at the top, and moisture accumulation was visible on the surface of the asphalt pad.

Use of galvanized drums (in the same storage environment) will increase significantly the direct burial storage life of painted carbon steel drums. Storage life of a direct buried DOT 17C galvanized drum will be at least 25 yr. The advantage of using galvanized drums is that the zinc coating will act as a sacrificial anode and will protect the drum in the high-humidity environment of the Hanford Site TRU waste storage pads.

It must be stated, however, that corrosion processes are quite variable, even in the same environment, and a wide degree of scatter in corrosion rates is typical.

In addition, in situ visual and photographic documentation of buried drums in 218-W-4C, trench 1 has been performed through an inspection. These drums were in the Z-9 Drum Storage Module. Photographic inspections in 1981, 1982, 1983, and 1988 provide some assurance that containers stored on asphalt pads will retain their integrity for the 20-yr storage period.

No inspection of boxed waste has been conducted at the Hanford Site.

6.5 CONCLUSIONS

Direct burial in soil will lead to container penetration and loss of structural integrity from corrosion in much less than 20 yr.

In direct burial container studies at the INEL, 65% of the containers stored for 18 to 21 yr were breached, with several containers having loss of structural integrity (Bishoff and Hudson 1979). Also, drums from the two INEL disposal pits, entered as part of the Initial Drum Retrieval Program, had breaches in 50% of the drums with all-plywood boxes being in "extremely poor" condition. The container storage time span was not clear but could have been from 9 to 23 yr. A shorter exposure time frame of 4 to 10 yr in the Initial Drum Retrieval Program resulted in only 2% of 20,262 drums breached with small holes.

In contrast, drum retrieval after 6 to 9 yr from plastic-covered drums at the TSA and at the INEL showed only 2 of 102 drums with "serious corrosion" but no breaches. Plastic covering of drums in above ground soil mounds at the SRP (with soil contacting the drums, under the plastic) resulting in over 17 mils or approximately 24% penetration in one drum after 8 1/2 yr of exposure. Plastic covering of drums below ground at the Hanford Site resulted in approximately one-half that amount of penetration in the same time frame.

The plastic serves as a means of keeping water and soil away from the containers. Surface moisture is the most significant factor in metal corrosion in soils or atmospheric environments, as it serves as an efficient electrolyte to enhance the processes of corrosion. Contact with soil or plastic will tend to keep moisture next to the metal surface for a longer time period and also lead to crevice corrosion or differential aeration corrosion. If soil is kept away by a plastic barrier, the corrosion will tend to be a slower atmospheric type. Atmospheric corrosion rates for a time span of 10 yr in an urban environment have been reported as averaging 0.48 mils/yr for carbon steel (ASM 1987). The high humidity (90%) reported for Hanford Site storage areas would be expected to lead to higher corrosion rates, which were indeed reported. However, high humidity conditions do not always lead to high corrosion rates. Corrosion rates on uncoated carbon steel in air at 100% humidity have been observed as low as approximately 0.16 mils/yr.

Previous estimates at the Hanford Site of buried container corrosion provided the following:

- Carbon steel drums stored for 10 to 12 yr at the Hanford Site in direct contact with the soil will have an approximate 5-mil/yr corrosion rate resulting in uncontained waste in a relatively short time (approximately 10 yr).
- Storage of galvanized drums in direct contact with soil will have twice the life of carbon steel drums.

A summary of actual waste-container examinations at the INEL and the SRP indicates the following.

- Storage of 18 to 21 yr, for carbon steel drums at the INEL in direct contact with soil, results in half of the drums being breached to the point where they no longer provide containment.
- Storage of 4 to 10 yr, at the INEL in direct contact with soil, results in 2% of the drums being breached with small holes. The containment feature at this point is considered marginally acceptable.
- Storage of 6 to 9 yr at the SRP, with a plastic barrier that eliminates contact with soil and moisture entry reduces the corrosion rate of galvanized drums to about 2/mils yr. This rate appears to be low enough that breached drums should not be encountered after a 20-yr storage period. The corrosion rate would be higher, however, if the nylon tarp is damaged thus letting moisture and soil enter the storage zone.

Based on a limited and not entirely consistent data base, drums that have been well protected from soil contact and moisture should last for 20 yr with a minimal percentage breached. Structural integrity should remain. Pooled moisture at the bottom of drum stacks, however, could severely impact the structural integrity of affected drums.

Based on the information above, it is anticipated that the wastes placed in trenches, which were not covered with plastic, will have a significant number of breached drums. The plywood containers will probably crumble. The FRP-and metal-box condition should provide containment. Their structural integrity for lifting and transport cannot be projected from the above data. Such waste includes the TRU waste emplaced in the 12B area (trenches 17 and 27), 3A area (trenches T01, T04, T06, T10, T15, T23, T30, T32, and T34), and 4B area (trench T11). The containers are projected to be deteriorated to the point where a full-containment facility would have to be erected over the retrieval area. Collectively, these containers constitute 79,220 ft² or 15% of the total TRU stored-waste inventory.

The remaining CH-TRU waste in 3A area (trenches TS6, TS9, T05, T08, and T17), constituting 124,200 ft³ or 23% of the total stored CH-TRU waste, may be only partially retrievable without a full-containment facility because of being emplaced next to buried LLW or breached due to container structural failure. The deterioration and radiation level of the LLW may also require a containment facility over the retrieval sites.

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APPENDIX A

**LISTING OF WASTE SOURCES INCLUDING
ANNUAL VOLUME AND NUMBER
OF DRUMS AND BOXES**

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TRU CONTAINERS FROM 1970 TO 1988

Year	Volume Cu. Ft.	Quantity of Containers			Volume Percent of Total
		Boxes	Drums	Other	
Babcock and Wilcox, Appolla, Pa.					
1981	5783		773		
1982	6011	22	223	1	
1983	1756	3	151		
Sub-total	13549	25	1147	1	2.49
U of C Lawrence Berkeley Labs, Berkeley, Calif.					
1982	8		1		
Sub-total	8	0	1	0	---
Bartleville Energy Technology Center, Bartleville, Okla.					
1981	23		3		
Sub-total	23	0	3	0	---
Energy Systems Group, Canoga Park, Calif.					
1980	296		40		
1983	8		1		
1984	1273		172		
1987	171		23		
Sub-total	1747	0	236	0	0.32
DOW Chemical Company, (Rocky Flats) Golden, Colo.					
1972	155		21		
1973	333		45		
1974	1058		143		
Sub-total	1547	0	209	0	0.28
EXXON Nuclear Systems, Richland, WA.					
1980	548		74		
1981	947		128		
1982	7		1		
Sub-total	1502	0	203	0	0.28
General Electric, Vallecitos, Calif.					
* 1974	3868	22*			
1981	2222	4	76		
1982	11590	31	74		
1983	3088	8			
Sub-total	20768	65	150	0	3.81

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TRU CONTAINERS FROM 1970 TO 1988

Year	Volume Cu. Ft.	Quantity of Containers			Volume Percent of Total
		Boxes	Drums	Other	

General Electric, Vallecitos, Calif. (routed thru 324 Bld, 300 Area)					
* 1984	147			6*	

Sub-total	147	0	0	6	---

General Electric, San Jose, Calif.					
1975	118		16		

Sub-total	118	0	16	0	---

Argonne National Labs, Argonne, Ill.					
1974	7		1		
1975	30		4		
1985	311		42		
1986	489		66		
1987	44		6		

Sub-total	882	0	119	0	0.16

200 West area JA Jones					
1970	348		47		
1971	348		47		
1972	1495		202		
1974	1468	6	17	5	
1981	920	2			
1982	1431	3			

Sub-total	6009	11	313	5	1.10

Kerr McGee, Crescent, Okla.					
1983	3416		461		
1984	1127		152		
1985	1409		190		
1986	1973		266		
1987	1127		152		

Sub-total	9052	0	1221	0	1.66

Lawrence Livermore Labs.					
1972	15		2		
1973	7		1		

Sub-total	22	0	3	0	---

Ceer University, Mayaguez, Puerto Rico					
1987	7		1		

Sub-total	7	0	1	0	---

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TRU CONTAINERS FROM 1970 TO 1988

Year	Volume Cu. Ft.	Quantity of Containers Boxes	Drums	Other	Volume Percent of Total

Battelle Columbus Labs, Columbus, Ohio					
1976	303		41		
1978	311		42		
1979	720	6			
1987	20			1	

Sub-total	1354	6	83	1	0.25

108F building, Pacific Northwest Labs, Richland, WA.					
1970	452		61		
1971	414		56		

Sub-total	866	0	117	0	0.16

144F building, Pacific Northwest Labs, Richland, WA.					
1970	22		3		
1971	8		1		
1972	579	6			
1973	432	2			

Sub-total	1041	8	4	0	0.19

1705F building, Pacific Northwest Labs, Richland, WA.					
1970	30		4		

Sub-total	30	0	4	0	---

1706K building, Pacific Northwest Labs, Richland, WA.					
1980	22		3		

Sub-total	22	0	3	0	---

209E building, Pacific Northwest Labs, Richland, WA.					
1970	44		6		
1971	96		13		
1972	81		11		
1973	22		3		
1974	67		9		
1975	59		8		
1976	22		3		
1977	30		4		
1978	112	1			
1980	67		9		
1981	111		15		
1984	112		15		
1985	141		19		
1986	67		9		

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TRU CONTAINERS FROM 1970 TO 1988

Year	Volume Cu. Ft.	Quantity of Containers			Volume Percent of Total
		Boxes	Drums	Other	

209E building, PNL (continued)					
1988	1097	6	20		

Sub-total	2128	7	144	0	0.39

231Z building, Pacific Northwest Labs, Richland, WA.					
1970	187		23	4	
1971	1600	1	86	2	
1972	1129	12	112		
1973	1288	5	166		
1974	1369		185		
1975	1339		181		
1976	703		95		
1977	1687		228		
1978	517	1	68		
1979	955		129		
1980	30374	17	27		
1981	3284	2	28		
1982	143		19		
1983	96		13		

Sub-total	44670	38	1360	6	8.20

242B building, Pacific Northwest Labs, Richland, WA.					
1974	28	1		2	

Sub-total	28	1	0	2	---

303C building, Pacific Northwest Labs, Richland, WA.					
1977	577		62	8	

Sub-total	577	0	62	8	0.11

308 building, Pacific Northwest Labs, Richland, WA.					
1970	127		10	13	
1985	30		4		
1987	44		6		

Sub-total	201	0	20	13	---

318 building, Pacific Northwest Labs, Richland, WA.					
1985	7		1		
1987	15		2		

Sub-total	22	0	3	0	---

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TRU CONTAINERS FROM 1970 TO 1988

Year	Volume Cu. Ft.	Quantity of Containers			Volume Percent of Total
		Boxes	Drums	Other	

324 building, Pacific Northwest Labs, Richland, WA.					
1979	90			6	
1980	60			4	
1984	111		15		
1987	36		1	1	

Sub-total	297	0	16	11	0.05

325 building, Pacific Northwest Labs, Richland, WA.					
1970	350		35	23	
1971	2412		326		
1972	4055		548		
1973	585		79		
1974	1017	3	52		
1975	922	1	121		
1976	416	1	53		
1977	244		33		
1978	864		40	11	
1979	1850		250		
1980	126		17		
1985	22		3		
1987	119		16		

Sub-total	12984	5	1573	34	2.38

325A building, Pacific Northwest Labs, Richland, WA.					
1975	2400			11	
1976	74		10		
1979	37		5		

Sub-total	2511	0	15	11	0.46

340 building, Pacific Northwest Labs, Richland, WA.					
1980	237		32		
1981	343		46		
1982	372	1	16		
1983	150		20		
1984	22		3		

Sub-total	1124	1	117	0	0.21

3706 building, Pacific Northwest Labs, Richland, WA.					
1970	40			1	

Sub-total	40	0	0	1	---

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TRU CONTAINERS FROM 1970 TO 1988

Year	Volume Cu. Ft.	Quantity of Containers			Volume Percent of Total
		Boxes	Drums	Other	

3708 building, Pacific Northwest Labs, Richland, WA.					
1975	158	1			

Sub-total	158	1	0	0	---

3720 building, Pacific Northwest Labs, Richland, WA.					
1987	7		1		

Sub-total	7	0	1	0	---

Rockwell International (Rocky Flats), Golden, Colo.					
1976	1606		217		
1979	1036		140		
1980	777		105		
1981	259		35		
1982	89		12		
1983	710		96		
1984	1184		159		

Sub-total	5661	0	764	0	1.04

International Atomic Energy Agency, Seibersdorf, Austria					
1986	7		1		

Sub-total	7	0	1	0	---

Westinghouse Advanced Reactor Division, Cheswick, Pa.					
1980	1927	11	48		
1981	9016	31	183		
1982	9494	38	304		
1983	9367	29	374		
1984	1135	5			

Sub-total	30939	114	909	0	5.68

WADCO, Westinghouse Hanford Company					
1970	7651	15			

Sub-total	7651	15	0	0	1.41

105C building, Westinghouse Hanford Company					
1971	64	1			

Sub-total	64	1	0	0	---

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TRU CONTAINERS FROM 1970 TO 1988

Year	Volume Cu. Ft.	Quantity of Containers			Volume Percent of Total
		Boxes	Drums	Other	

105KE building, Westinghouse Hanford Company					
1976	1200	13	34	4	
1977	382	4	4		
1978	560	5			
1979	77			1	

Sub-total	2218	22	38	5	0.41

105N building, Westinghouse Hanford Company					
1971	15		2		
1975	845			1	
* 1983	29			1*	

Sub-total	888	0	2	2	0.16

200 West Area Tank Farms, Westinghouse Hanford Company					
1974	215		29		
1979	163		22		
1980	44		6		

Sub-total	422	0	57	0	0.08

202A building, Westinghouse Hanford Company					
1970	2829		382	1	
1971	5978	20	712	16	
1972	3447	8	406	10	
1973	696		94		
1974	591	3	68		
1975	389		31	8	
1977	1280	1			
1978	1474	7	10		
1979	488		66		
1981	4605	3			
1982	1680		227		
1983	74		10		
1984	1111	2	81		
1985	1915	4	86		
1986	623		84		
1987	675		91		
1988	363		49		

Sub-total	28218	48	2397	35	5.18

202AL building, Westinghouse Hanford Company					
1970	3167		416	5	
1971	4250		571	5	
1972	3255		437	5	
1973	185		25		
1974	96		13		

TRU CONTAINERS FROM 1970 TO 1988

Year	Volume Cu. Ft.	Quantity of Containers			Volume Percent of Total
		Boxes	Drums	Other	
202AL building, WHC (continued)					
1975	30		4		
1976	22		3		
1977	30		4		
1978	37		5		
1979	44		6		
Sub-total	11117	0	1484	15	2.04
21629 Crib Area, Westinghouse Hanford Company					
1978	74		10		
1979	4077		551		
1980	1044		141		
Sub-total	5196	0	702	0	0.95
221TS building, Westinghouse Hanford Company					
1970	89		12		
1971	37		5		
1972	111		15		
1974	15		2		
Sub-total	252	0	34	0	---
222S building, Westinghouse Hanford Company					
1970	260		34	2	
1971	344		46	1	
1972	115		15	1	
1973	367		48	3	
1974	312		41	2	
1975	259		35		
1976	252		34		
1977	318		43		
1978	74		10		
1981	1536	1			
1985	22		3		
Sub-total	3860	1	309	9	0.71
233S building, Westinghouse Hanford Company					
1979	155		21		
1980	266		36		
Sub-total	422	0	57	0	0.08
2345Z building, Westinghouse Hanford Company					
1970	9813	1	1102	8	
1971	12969	11	1344	6	
1972	12276	15	1306	1	

TRU CONTAINERS FROM 1970 TO 1988

Year	Volume Cu. Ft.	Quantity of Containers			Volume Percent of Total
		Boxes	Drums	Other	

2345Z building, WHC (continued)					
1973	10082	3	1264	3	
1974	10666	10	942	9	
1975	67314	51	1222		
1976	27904	17	1025	14	
1977	12984	4	1199		
1978	20737	27	900		
1979	11610		1569		
1980	19984	7	1658	13	
1981	14784	5	830	70	
1982	5326		672	29	
1983	7739	1	949	79	
1984	13742		1855	1	
1985	24971	42	1782		
1986	4249		573		
1987	3152		425		
1988	1587		214		

Sub-total	291888	194	20831	233	53.60

2724W building, Westinghouse Hanford Company					
1971	8		1		

Sub-total	8	0	1	0	---

308 building, Westinghouse Hanford Company					
1970	189		25	1	
1981	506	1			
1986	89		12		
1987	326		44		

Sub-total	1110	1	81	1	0.20

324 building, Westinghouse Hanford Company					
1983	263		35		
1984	518		70		
1985	549		74		
1986	119		16		
* 1987	123			5*	

Sub-total	1571	0	195	5	0.29

325 building, Westinghouse Hanford Company					
1970	959		67	22	
1971	1786		236	2	
1972	2694	20	238	5	
1973	1606		217		
1974	3596	9	254	14	
1975	3183	6	218		

BCA3A DATA

APPENDIX A

Page 10

TRU CONTAINERS FROM 1970 TO 1988

Year	Volume Cu. Ft.	Quantity of Containers			Volume Percent of Total
		Boxes	Drums	Other	

325 building, WHC (continued)					
1976	1474	2	162	1	
1977	1525	1	140	1	
1978	2658	10	307		
1979	3234		437		
1980	1079	1	91		
1985	249	1			

Sub-total	24044	50	2367	45	4.42

327C building, Westinghouse Hanford Company					
1971	80	5			
* 1981	74			3*	
* 1982	25			1*	
* 1987	96		13*		

Sub-total	275	5	13	4	0.05

340 building, Westinghouse Hanford Company					
1980	577		78		
1981	1451	3	93		
1982	2951	4	46		
1983	143		19		
1987	141		19		

Sub-total	5263	7	255	0	0.97

3708 building, Westinghouse Hanford Company					
1970	37			9	

Sub-total	37	0	0	9	---

Grand total	544548	626	37641	462	99.78

* Contains High Level Waste.

APPENDIX B

**LISTING OF WASTE CONTAINERS
BY GENERATOR**

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BCA3B DATA

APPENDIX B

Page 1

OTHER TRU CONTAINERS FROM 1970 TO 1988

Year	Generator	Other Container Types	Quantity of Containers	Volume Cu. Ft.
Babcock and Wilcox, Appolla, Pa.				
1982	APA	BABCX METAL TANK- 4 DIA X 4	1	72
General Electric, Vallecitos, Calif. (routed thru 324 Bld, 300 Area)				
* 1984	GE	324 EBR II CASK	6	147
200 West area JA Jones				
1974	JAJ	200W LARD CANS / 5 GALLON	4	2
1974	JAJ	200W TANKS- DECON / CYLINDER	1	300
Battelle Columbus Labs, Columbus, Ohio				
1987	OHO	BATCO COMPRESSORS / CASKS	1	20
231Z building, Pacific Northwest Labs, Richland, WA.				
1970	PNL	231Z METAL CONTAINERS (30 GAL)	4	16
1971	PNL	231Z EQUIPMENT	1	32
1971	PNL	231Z VENT PIPES	1	31
242B building, Pacific Northwest Labs, Richland, WA.				
1974	PNL	242B HEPA FILTERS	2	16
303C building, Pacific Northwest Labs, Richland, WA.				
1977	PNL	303C 110 GALLON	8	118
308 building, Pacific Northwest Labs, Richland, WA.				
1970	PNL	308 METAL CONTAINERS (30 GAL)	13	53
324 building, Pacific Northwest Labs, Richland, WA.				
1979	PNL	324 COMPRESSORS / CASKS	6	90
1980	PNL	324 COMPRESSORS / CASKS	4	60
1987	PNL	324 COMPRESSORS / CASKS	1	29
325 building, Pacific Northwest Labs, Richland, WA.				
1970	PNL	325 METAL CONTAINERS (30 GAL)	23	94
1978	PNL	325 METAL SCRAP	5	6
1978	PNL	325 PIPE - PLASTIC OR METAL	3	2
1978	PNL	325 PLASTIC BAGS/TUBES	1	9
1978	PNL	325 PUMP	1	1
1978	PNL	325 TANKS- DECON / CYLINDER	1	550
325A building, Pacific Northwest Labs, Richland, WA.				
1975	PNL	325A COMPRESSORS / CASKS	11	2400
3706 building, Pacific Northwest Labs, Richland, WA.				
1970	PNL	3706 VENT PIPES	1	40
105KE building, Westinghouse Hanford Company				
1976	WHC	105KE HANFORD STANDARD CARTON	2	9
1976	WHC	105KE LARGE CARDBOARD BOX	1	36

BCA3B DATA

APPENDIX B

Page 2

OTHER TRU CONTAINERS FROM 1970 TO 1988

Year	Generator	Other Container Types	Quantity of Containers	Volume Cu. Ft.

1976	WHC	105KE TRUCK LOAD - MISC.	1	23
1979	WHC	105KE ION EXCHANGE COLUMN - UNC	1	77

105N building, Westinghouse Hanford Company				
1975	WHC	105N EQUIPMENT	1	845
* 1983	WHC	105N COMPRESSORS / CASKS	1	29

202A building, Westinghouse Hanford Company				
1970	WHC	202A SMALL BOX 2 CU. FT.	1	2
1971	WHC	202A HANFORD STANDARD CARTON	12	54
1971	WHC	202A IRON DRUM 3 X 3 X 4	4	144
1972	WHC	202A HANFORD STANDARD CARTON	2	9
1972	WHC	202A HEPA FILTERS	8	174
1975	WHC	202A HEPA FILTERS	8	160

202AL building, Westinghouse Hanford Company				
1970	WHC	202AL HANFORD STANDARD CARTON	5	23
1971	WHC	202AL EQUIPMENT	1	7
1971	WHC	202AL HANFORD STANDARD CARTON	2	9
1971	WHC	202AL METAL CONTAINERS (30 GAL)	2	8
1972	WHC	202AL HANFORD STANDARD CARTON	2	9
1972	WHC	202AL METAL CONTAINERS (30 GAL)	3	12

222S building, Westinghouse Hanford Company				
1970	WHC	222S METAL CONTAINERS (30 GAL)	2	8
1971	WHC	222S METAL CONTAINERS (30 GAL)	1	4
1972	WHC	222S METAL CONTAINERS (30 GAL)	1	4
1973	WHC	222S METAL CONTAINERS (30 GAL)	3	12
1974	WHC	222S METAL CONTAINERS (30 GAL)	2	8

2345Z building, Westinghouse Hanford Company				
1970	WHC	2345Z METAL CONTAINERS (30 GAL)	8	33
1971	WHC	2345Z EQUIPMENT	1	144
1971	WHC	2345Z METAL CONTAINERS (30 GAL)	5	20
1972	WHC	2345Z 110 GALLON	1	15
1973	WHC	2345Z 110 GALLON	3	44
1974	WHC	2345Z 110 GALLON	9	133
1976	WHC	2345Z 110 GALLON	14	207
1980	WHC	2345Z L-10 CONTAINER	13	192
1981	WHC	2345Z L-10 CONTAINER	63	932
1981	WHC	2345Z 3 L CONTAINER	7	32
1982	WHC	2345Z L-10 CONTAINER	7	104
1982	WHC	2345Z METAL CONTAINERS (30 GAL)	4	19
1982	WHC	2345Z 110 GALLON	15	215
1982	WHC	2345Z 3 L CONTAINER	3	14
1983	WHC	2345Z PALLETS	1	5
1983	WHC	2345Z PR CANS	78	457
1984	WHC	2345Z PIPE - PLASTIC OR METAL	1	7

BCA3B DATA

APPENDIX B

Page 3

OTHER TRU CONTAINERS FROM 1970 TO 1988

Year	Generator	Other Container Types	Quantity of Containers	Volume Cu. Ft.

308 building, Westinghouse Hanford Company				
1970	WHC 308	METAL CONTAINERS (30 GAL)	1	4

324 building, Westinghouse Hanford Company				
* 1987	WHC 324	EBR II CASK	5	123

325 building, Westinghouse Hanford Company				
1970	WHC 325	HEPA FILTERS	5	394
1970	WHC 325	METAL CONTAINERS (30 GAL)	17	70
1971	WHC 325	METAL CONTAINERS (30 GAL)	1	4
1971	WHC 325	TANKS- DECON / CYLINDER	1	36
1972	WHC 325	VENT PIPES	5	21
1974	WHC 325	EQUIPMENT	4	182
1974	WHC 325	HEPA FILTERS	4	108
1974	WHC 325	TANKS- DECON / CYLINDER	6	40
1976	WHC 325	110 GALLON	1	15
1977	WHC 325	CONCRETE CULVERT - 7 DIA X 12	1	462

327C building, Westinghouse Hanford Company				
* 1981	WHC 327C	EBR II CASK	3	74
* 1982	WHC 327C	EBR II CASK	1	25

3708 building, Westinghouse Hanford Company				
1970	WHC 3708	METAL CONTAINERS (30 GAL)	9	37

Grand Total			462	9923

* Contains High Level Waste.

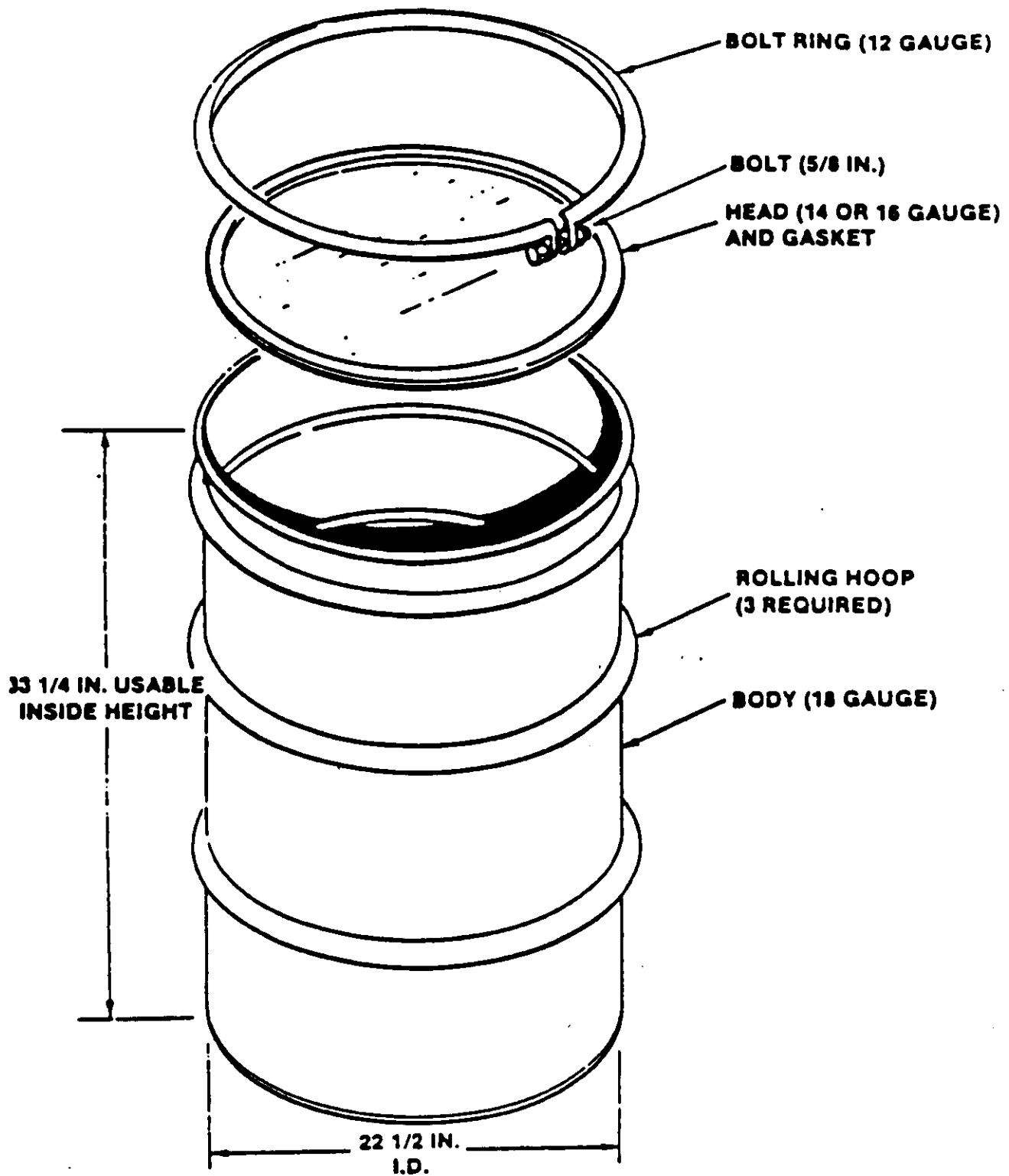
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APPENDIX C

DRAWINGS OF TYPICAL CONTAINERS

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DOT SPEC. 17H DRUM (55 GALLON)



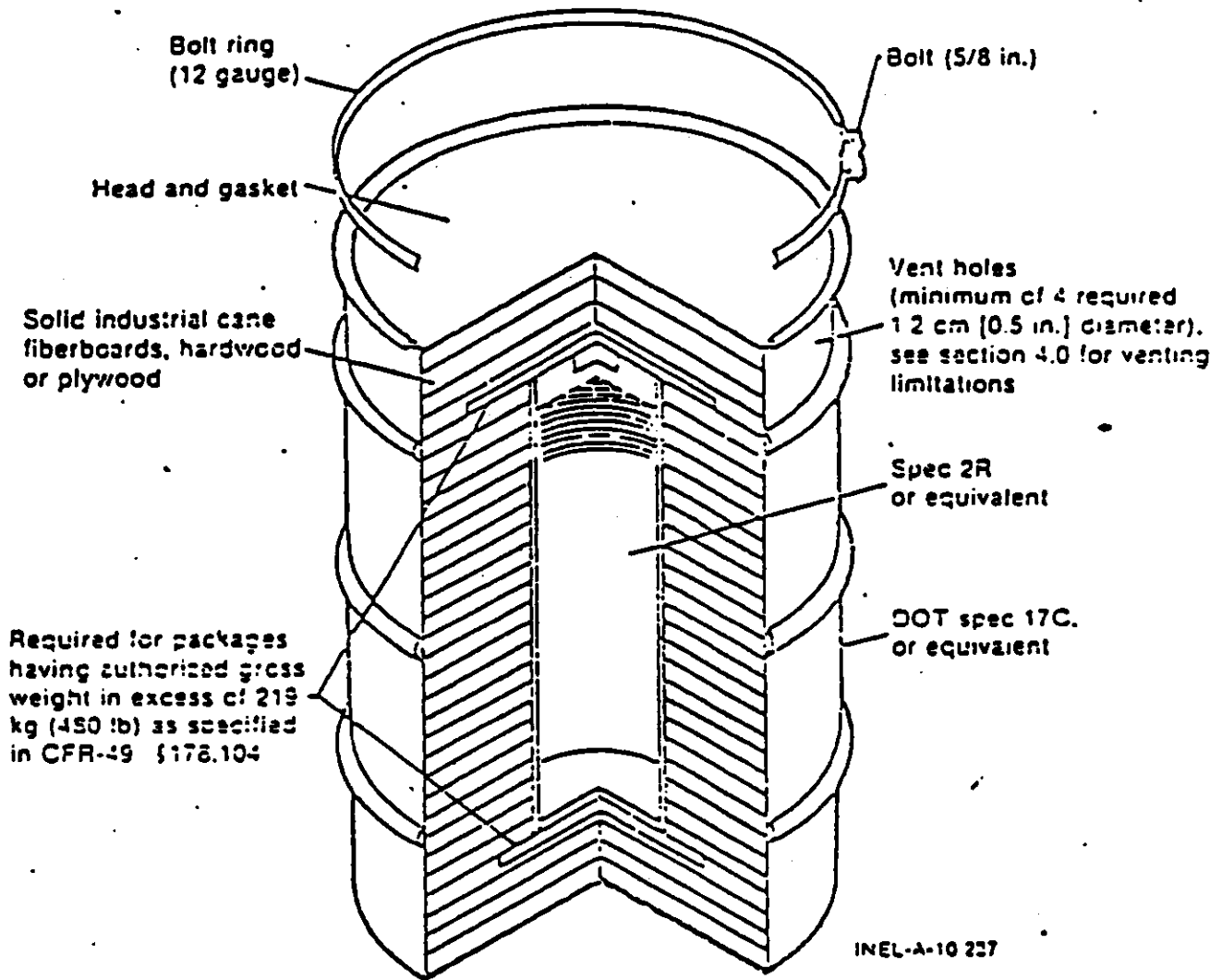
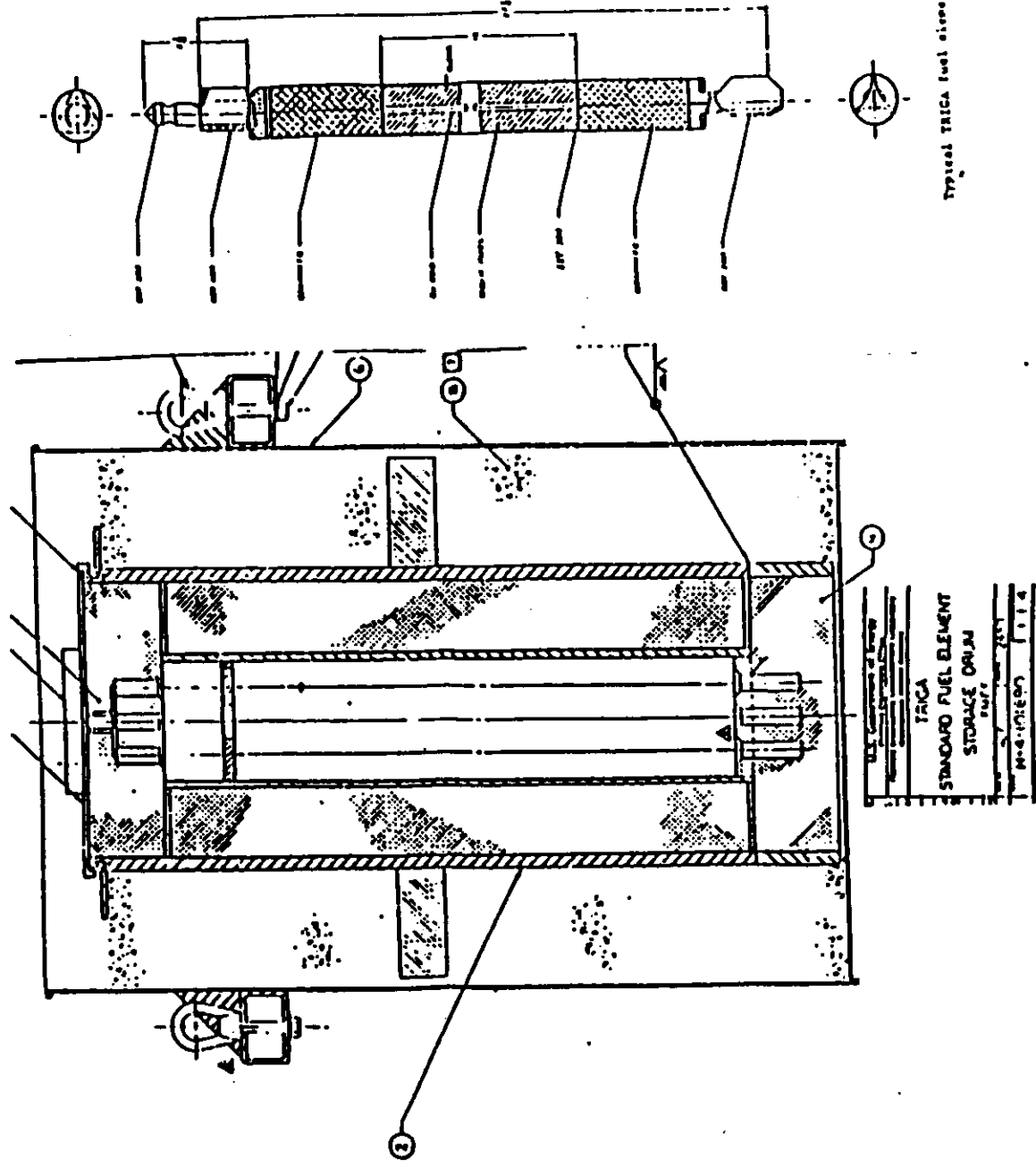


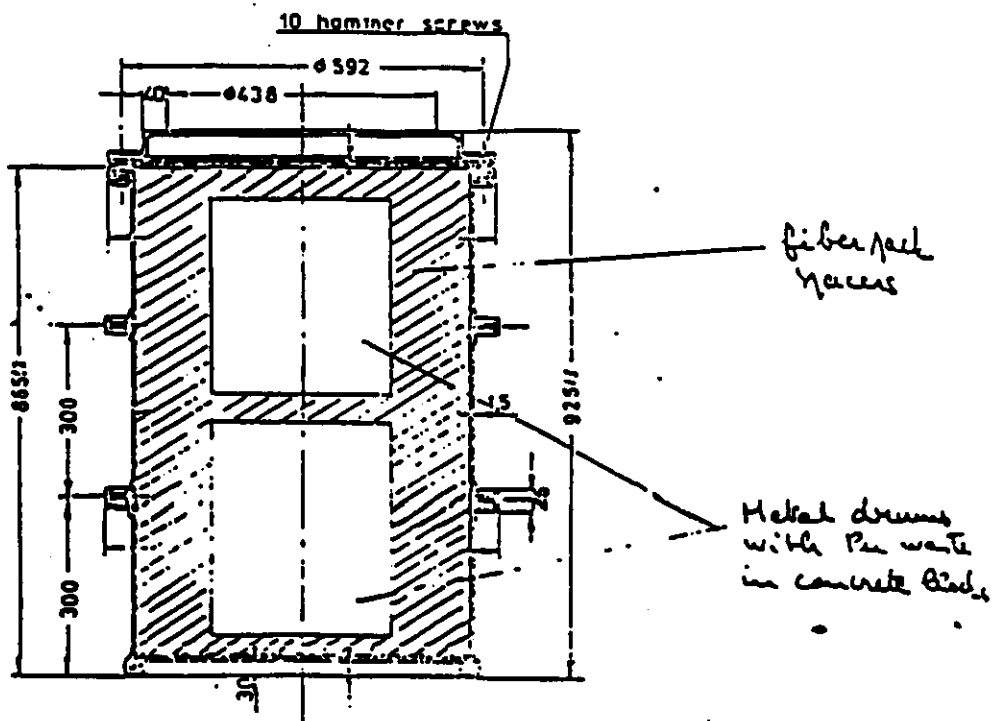
Fig. 2 DOT Spec 61 packaging.



Wolfgang
24.172

Waste-Drum
Assembly Drawing

100-008-00
revised



Main data

weight: \approx 60 kp

authorization: type B, but only together with corresponding
Pu-waste-overpack (see drawing no. 050-019-oc)

scale 1:10



TRANSNUCLEAR GERMANY

1. Wavelength - distance between two consecutive crests or troughs of a wave.
 2. Frequency - number of waves passing a point in a unit of time.
 3. Amplitude - height of a wave from its rest position to its crest or trough.
 4. Period - time taken for one complete wave cycle to pass a point.
 5. Wave speed - distance traveled by a wave in a unit of time.

6. *Handwritten text, likely bleed-through from the reverse side of the page.*

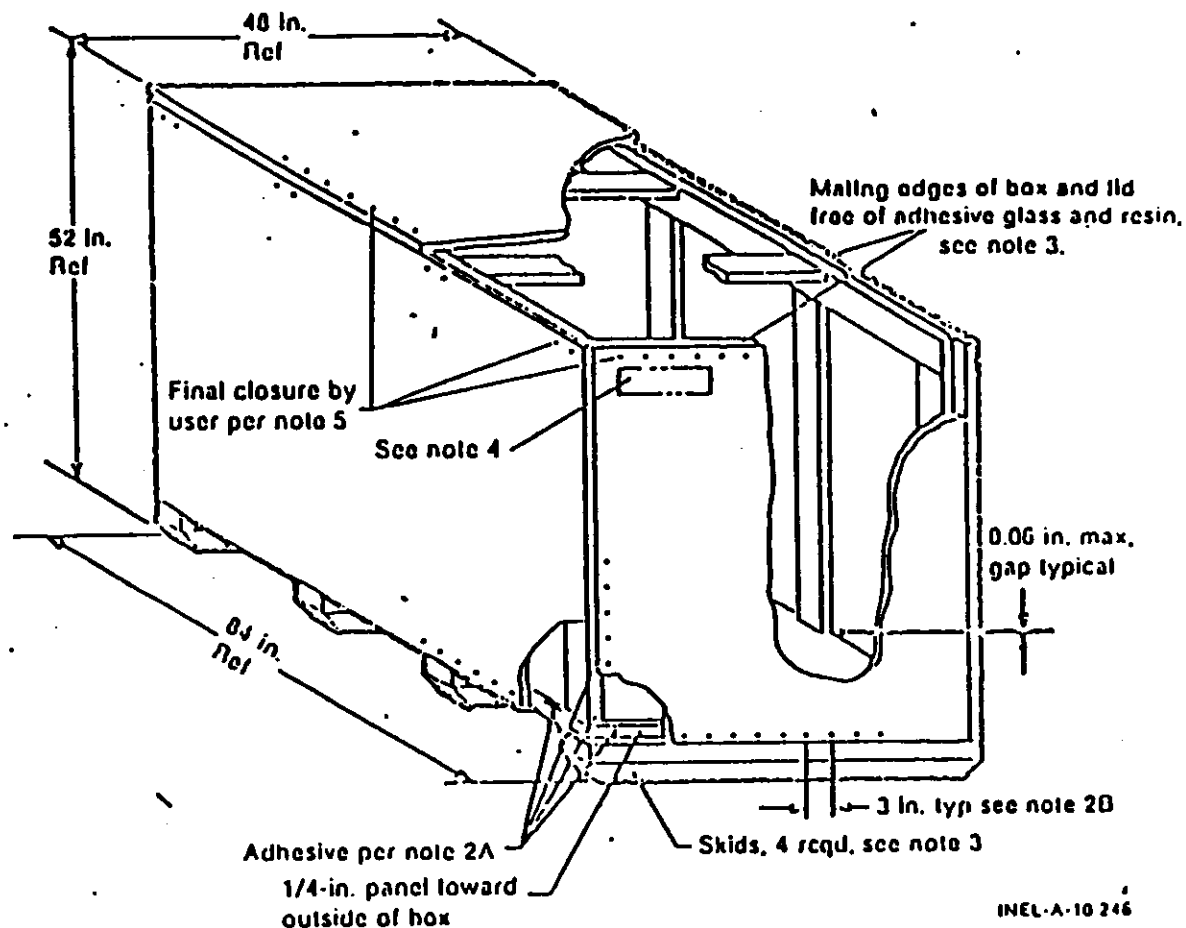
- [illegible]

- [illegible]

- [illegible]

- [illegible]

൧. നമ്മുടെ നമ്മെ ഉപയോഗിച്ച് നമ്മുടെ നമ്മെ മറ്റും ഉപയോഗിക്കുക -
 നമ്മുടെ നമ്മെ ഉപയോഗിച്ച് നമ്മുടെ നമ്മെ മറ്റും ഉപയോഗിക്കുക
 ൨. നമ്മുടെ നമ്മെ ഉപയോഗിച്ച് നമ്മുടെ നമ്മെ മറ്റും ഉപയോഗിക്കുക -
 നമ്മുടെ നമ്മെ ഉപയോഗിച്ച് നമ്മുടെ നമ്മെ മറ്റും ഉപയോഗിക്കുക



DOT 7A flush panel plywood box assembly..

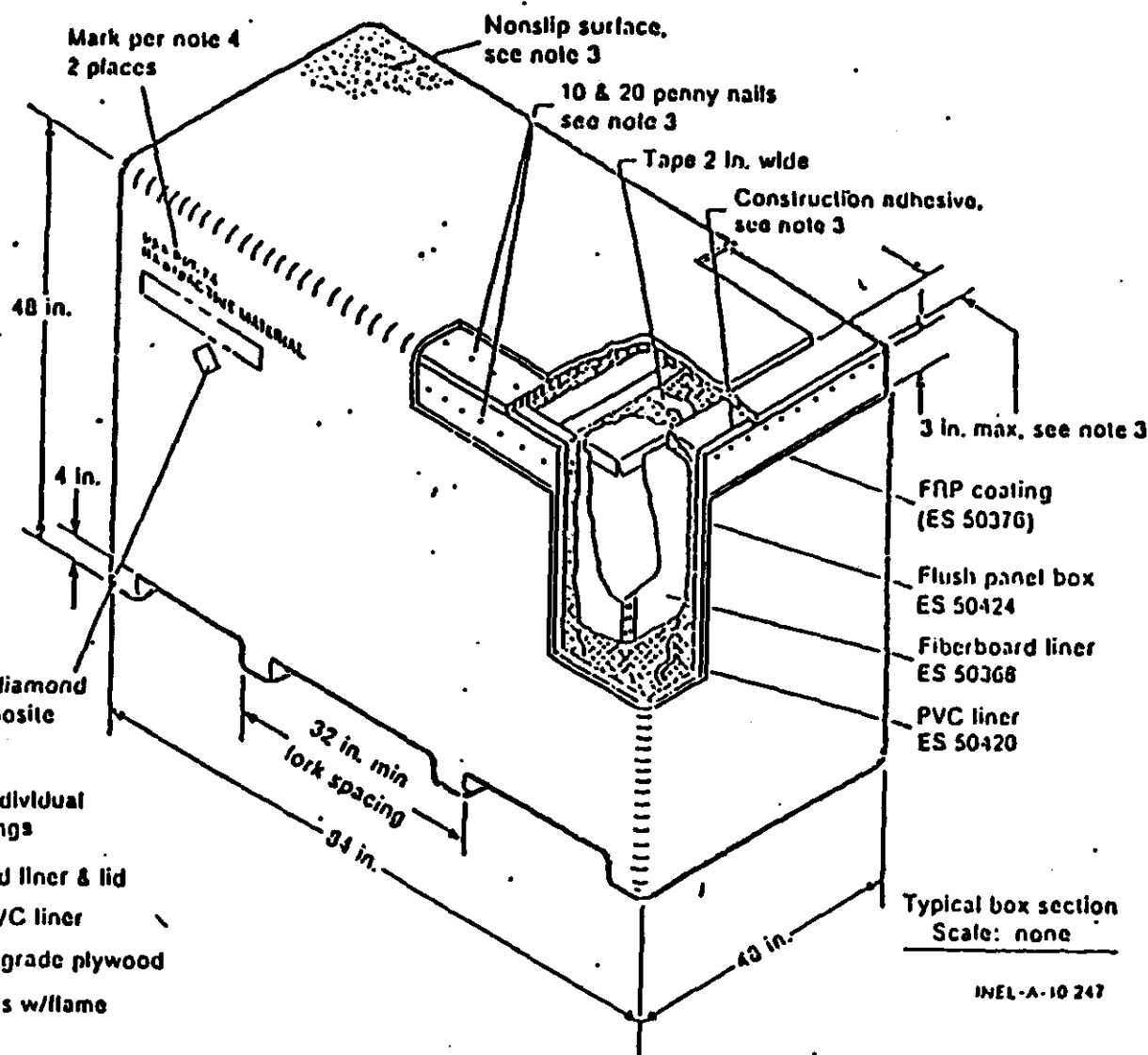
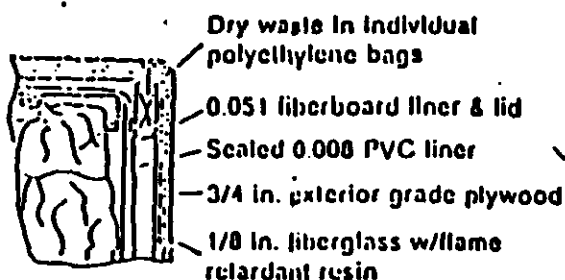
INEL-A-10 246

NOTES

1. See safety data sheet for handling instructions. This box is for use only for the purpose of transporting and storing radioactive material. It is not to be used for any other purpose. The box is to be used only for the purpose of transporting and storing radioactive material.
2. The box is to be used only for the purpose of transporting and storing radioactive material. It is not to be used for any other purpose. The box is to be used only for the purpose of transporting and storing radioactive material.
3. The box is to be used only for the purpose of transporting and storing radioactive material. It is not to be used for any other purpose. The box is to be used only for the purpose of transporting and storing radioactive material.
4. The box is to be used only for the purpose of transporting and storing radioactive material. It is not to be used for any other purpose. The box is to be used only for the purpose of transporting and storing radioactive material.
5. The box is to be used only for the purpose of transporting and storing radioactive material. It is not to be used for any other purpose. The box is to be used only for the purpose of transporting and storing radioactive material.
6. The box is to be used only for the purpose of transporting and storing radioactive material. It is not to be used for any other purpose. The box is to be used only for the purpose of transporting and storing radioactive material.

Dimensions	Weight
Box only (lb)	52
Box + contents (lb)	78

Radioactive material diamond label, 2 places on opposite sides of box

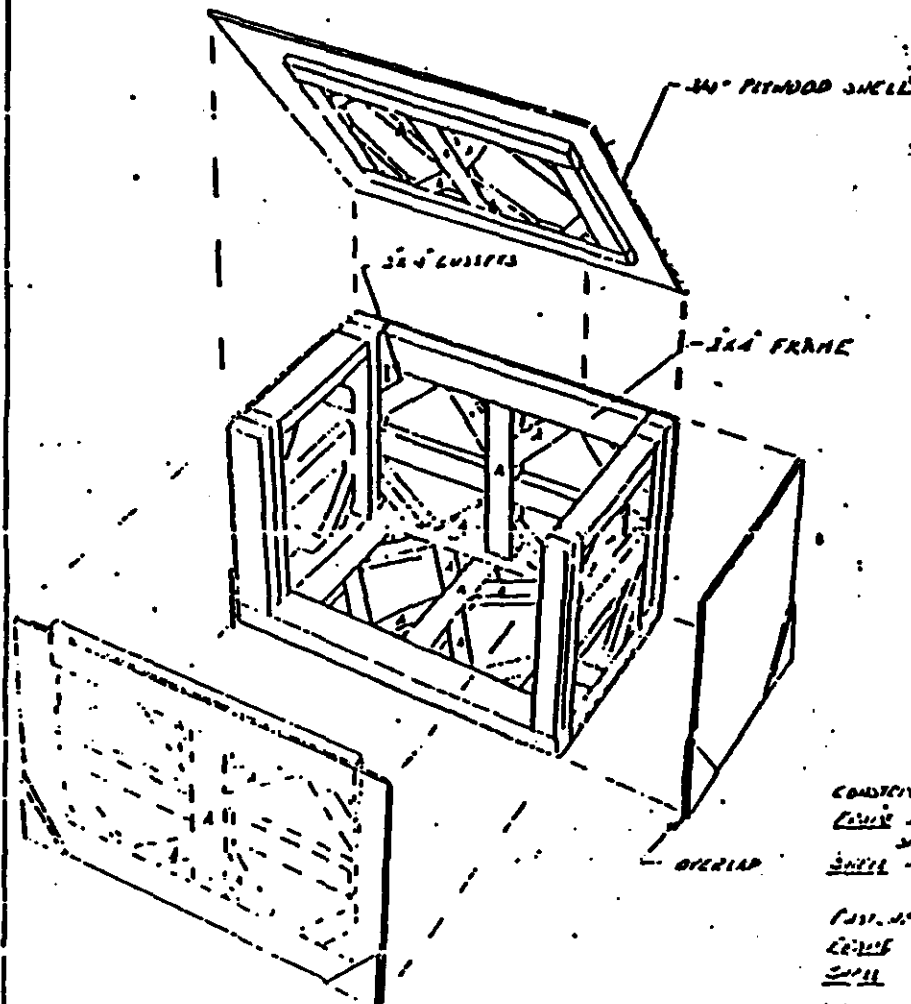


DOT 7A fiberglass reinforced flush panel box assembly.

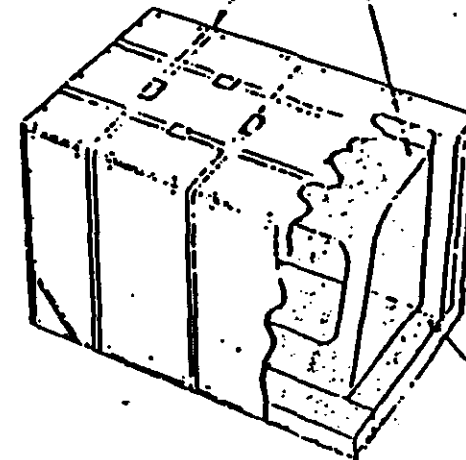
BABCOCK & WILCOX
NUCLEAR MATERIALS & MANUFACTURING DIVISION
(Spartanburg, S.C.)

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GLOVE BOX WITH INTERIOR RIGID FRAME



**SLIDE RAILS THE
STEEL BANDS ON
16\"**



**THIS GLOVE BOX
IS DESIGNED TO
HANDLE RADIOACTIVE
MATERIALS
IN A SAFE MANNER
AND TO PROTECT
THE OPERATOR
FROM RADIATION**

CONSTRUCTION MATERIALS:

FRAME 3/4\"
SHIELDING 1/2\"
SHIELD 1/2\"
SHIELD 1/2\"

FASTENERS:

SCREWS 1/2\"
SCREWS 1/2\"
SCREWS 1/2\"

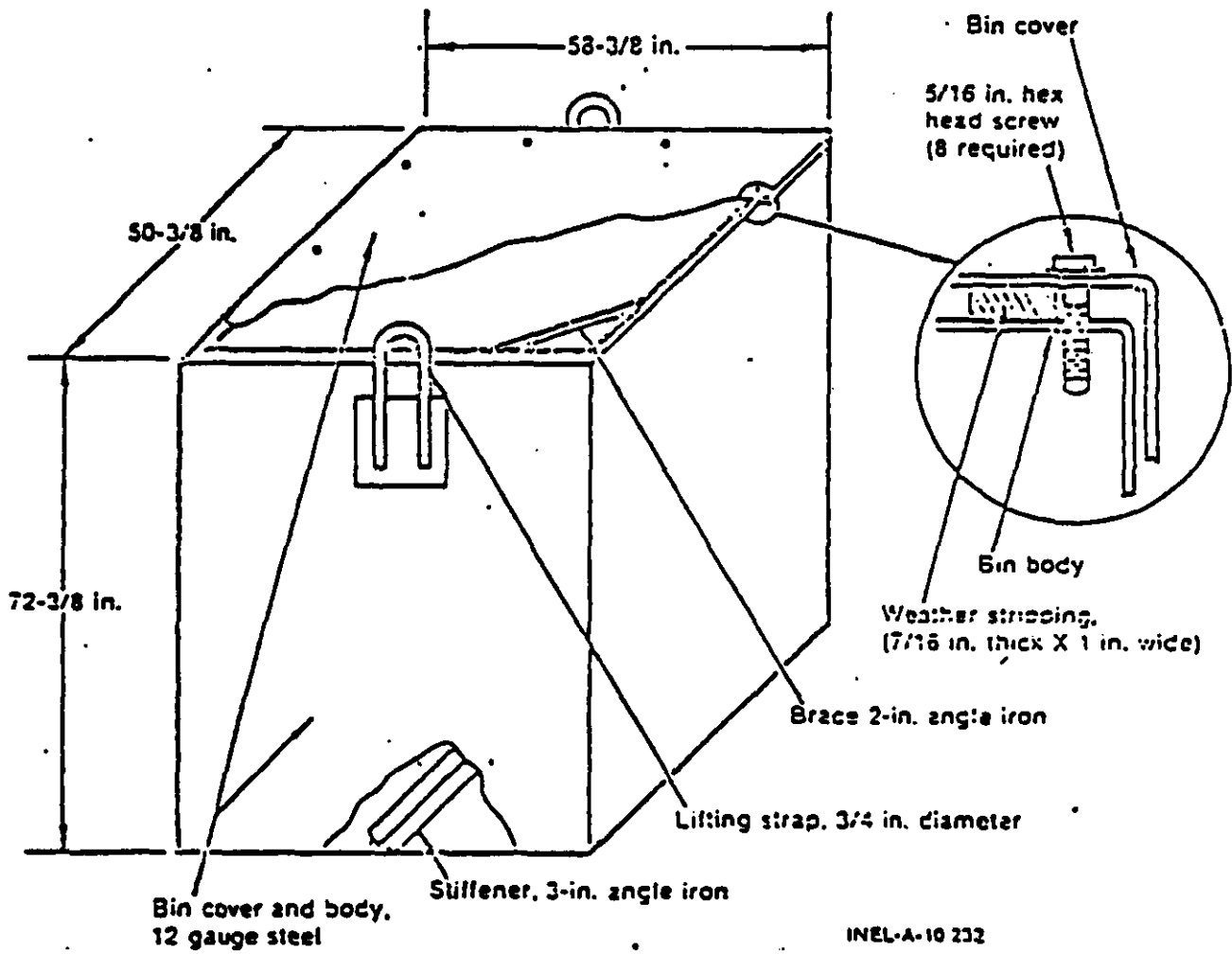
NOTE:

1. THE 3/4\"
2. APPLY SOLDER TO THE BOTTOM TO ALLOW

Babcock & Wilcox
 Nuclear Materials Division
 Spartanburg, S.C. 29591

TYPICAL GLOVE BOX CONFIGURATION

11-B-300

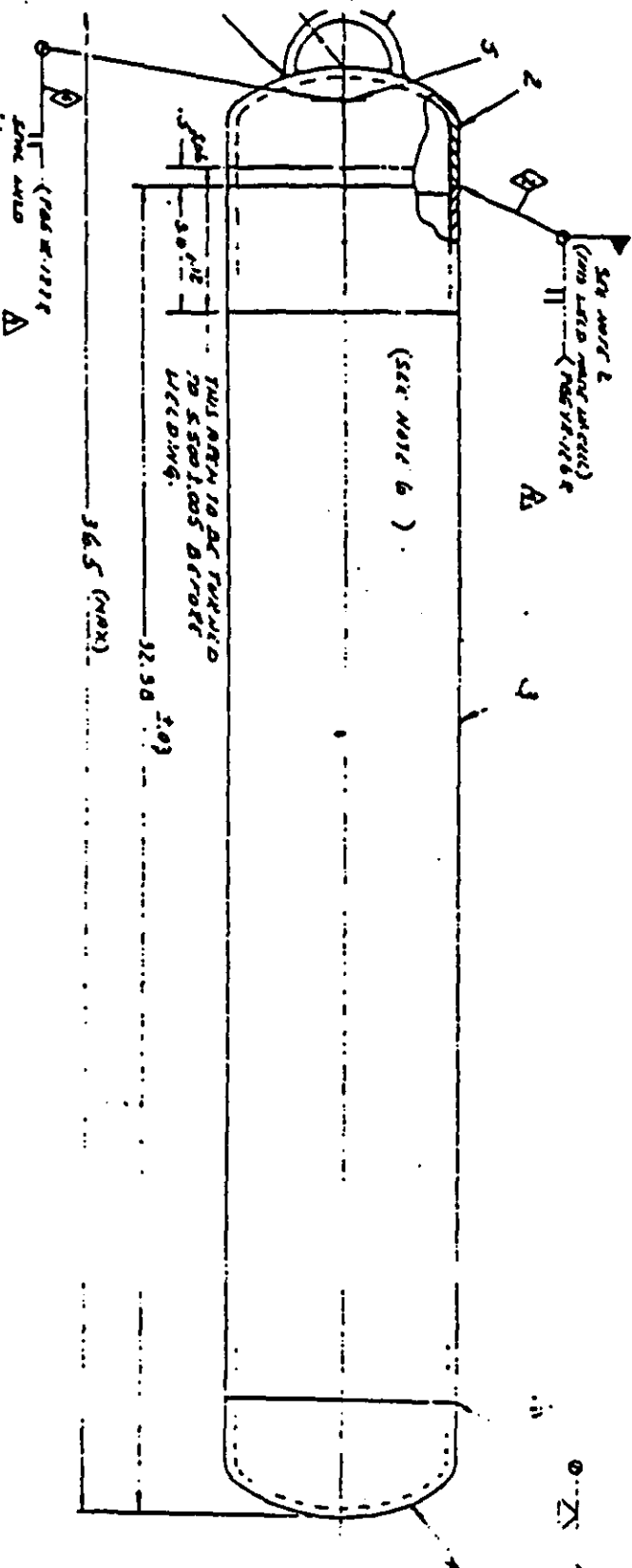


DOT Spec 7A steel box.

DESIGN OFFICE: AT PROJECT NUMBER: Y101093 DRAWING NUMBER: 125		REVISIONS NO. 1 DATE: 12/29	
--	--	--	--

NO.	NAME	DATE
1	BOYLE	12/29
2	CHANDLER	12/29
3	CHANDLER	12/29
4	CHANDLER	12/29
5	CHANDLER	12/29

ORDER: SEE 60 IN THE "NOTES" SECTION
 IN THE LIDED VIBRATION
 ** (SEE NOTE 6) **
 TO SEE 60.





APPENDIX D

LISTING OF CONTAINERS BY TYPE, SIZE, AND QUANTITY

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APPXD DATA

APPENDIX D

BOXES PLACED IN RETRIEVABLE STORAGE FROM 1970-1988

Type	Nominal Size (ft)	Quantity
Plywood Boxes	3.17 X 5 X 10.3	1
	4 X 4 X 4	17
	4 X 4 X 5	3
	4 X 4 X 8	3
	4 X 5 X 6	1
	4.08 X 4.58 X 12.08	1
	4.08 X 4.75 X 12.08	1
	4.08 X 8.83 X 12.75	1
	4.75 X 4.75 X 5.75	1
	5.08 X 6.75 X 6.92	1
	5.25 X 10.75 X 9.17	1
	5.25 X 15.25 X 9.33	1
	5.33 X 9.75 X 16.08	1
	5.42 X 11.33 X 17.75	1
	5.75 X 8.08 X 10.75	1
	5.75 X 9.67 X 10.83	1
	7.83 X 16.83 X 15.5	1
	TOTAL	37
FRP Boxes	6.5 X 8 X 14.6	9
	6.5 X 8 X 18.5	3
	10.5 X 10.67 X 12	5
	3.8 X 4.3 X 12.5	1
	4 X 4 X 7	35
	4.6 X 5.1 X 11.8	1
	4.7 X 7.8 X 11	11
	4.83 X 5 X 8	2
	5 X 6 X 16	1
	5.3 X 5.7 X 7.3	3
	5.3 X 5.7 X 9.8	6
	5.5 X 5.7 X 11.2	3
	5.6 X 7.3 X 10.1	16
	5.6 X 7.4 X 11.3	3
	5.8 X 5.8 X 10.6	2
	5.8 X 5.8 X 9.6	7
	6 X 6 X 6	7
	6 X 6.1 X 9.6	1
	6.2 X 6.2 X 9	4
	6.33 X 8 X 14.67	1
	8 X 10 X 16	5
	8 X 8 X 10.7	2
	8.25 X 10.58 X 19.58	1
	9 X 10.67 X 12	17
	9 X 10.67 X 16	23
	9 X 10.67 X 20	17
	9 X 11.67 X 20	7
	9 X 12 X 12.67	1

APPXD DATA

APPENDIX D

BOXES PLACED IN RETRIEVABLE STORAGE FROM 1970-1988

Type	Nominal Size (ft)	Quantity
FRP Boxes (cont)	9 X 12.67 X 20	7
	9.5 X 9.94 X 12	1
	TOTAL	202
Metal Boxes	4 X 5 X 6	72
	2 X 2 X 3	18
	2 X 2 X 6	1
	2 X 3 X 15	1
	2 X 4 X 8	1
	2.5 X 2.5 X 4	25
	3 X 3 X 4	4
	3 X 4 X 10	2
	3 X 4 X 7	1
	3 X 5 X 8	2
	3.17 X 4.5 X 6.67	1
	3.5 X 6 X 8	1
	4 X 4 X 4	5
	4 X 4 X 5	2
	4 X 4 X 7	8
	4 X 4 X 8	1
	4 X 5 X 6	1
	4 X 5 X 9	1
	4 X 5.5 X 16	1
	4 X 6 X 10	6
	4 X 6 X 15	2
	4 X 6 X 16.5	1
	4 X 8 X 10	1
	4 X 8 X 16	1
	4.17 X 6.25 X 15.56	1
	4.25 X 2.63 X 2.63	3
	4.5 X 6 X 10	1
	5 X 10 X 13	1
	5 X 5 X 5	1
	5 X 5 X 7	7
	5 X 5 X 9	1
	5 X 6 X 11	1
	5 X 7 X 17	1
	5.21 X 7.13 X 10.5	9
	5.21 X 7.13 X 16.5	4
	5.4 X 5.6 X 6.8	14
	5.43 X 7.7 X 11	4
	6 X 6 X 7	32
	6 X 7.1 X 12	3
	6 X 8 X 12	1
	7 X 10 X 16	1
	7 X 12 X 16	1
	RECORDED ONLY BY VOLUME	84
	TOTAL	329

APPXD DATA

APPENDIX D

BOXES PLACED IN RETRIEVABLE STORAGE FROM 1970-1988

Type	Nominal Size (ft)	Quantity
-----	-----	-----
Misc Cardboard Boxes	HANFORD STANDARD CARTON	25
	(18" X 18" X 24")	
	LARGE CARDBOARD BOX	1
	SMALL BOX 2 CU. FT.	1

	TOTAL	27
Misc Packages	EQUIPMENT	8
	METAL SCRAP	5
	PALLETS	1
	PIPE - PLASTIC OR METAL	4
	PLASTIC BAGS/TUBES	1
	PUMP	1
	TRUCK LOAD - MISC.	1
	VENT PIPES	7

	TOTAL	28
Misc Cylindrical Containers	COMPRESSORS / CASKS	24
	CONCRETE CULVERT - 7 DIA X 12	1
	EBR II CASK	15
	ION EXCHANGE COLUMN - UNC	1
	IRON DRUM 3 X 3 X 4	4
	L-10 CONTAINER	83
	LARD CANS / 5 GALLON	4
	METAL CONTAINERS (30 GAL)	99
	METAL TANK- 4 DIA X 4	1
	PR CANS	78
	TANKS- DECON / CYLINDER	9
	110 GALLON	51
	3 L CONTAINER	10

	TOTAL	380
HEPA Filters	HEPA FILTERS	27
55 Gallon Drum	55 GALLON DRUM	37641
Concrete Boxes	BOX/BLOCKS MISC. SIZES	1
	121 CU. FT.	4
	2.5 X 2.5 X 2.5	5
	3 X 3 X 3	24
	4 X 4 X 4	3
	4 X 4 X 8	1
	4 X 7 X 9	2
	5.46 X 5.46 X 6.29	18

	TOTAL	58

APPXD DATA

APPENDIX D

BOXES PLACED IN RETRIEVABLE STORAGE FROM 1970-1988

Type	Nominal Size (ft)	Quantity
------	-------------------	----------

Summary of Box Totals

Type	Quantity	Volume Cu. Ft.	Volume m3
Misc Containers			
Misc Cardboard Boxes *	27	1.507E+02	4.267E+00
Misc Packages *	28	1.356E+03	3.841E+01
Misc Cylindrical Containers	380	7.564E+03	2.142E+02
HEPA Filters	27	8.524E+02	2.414E+01
TOTAL Misc Containers	462	9.923E+03	2.810E+02
TOTAL 55 Gallon Drum	37641	2.791E+05	7.904E+03
Boxes			
Concrete	58	7.024E+03	1.989E+02
FRP	202	1.728E+05	4.892E+03
Plywood	37	9.943E+03	2.816E+02
Metal	329	6.576E+04	1.862E+03
TOTAL Boxes	626	2.555E+05	7.235E+03
TOTAL TRU Containers	38729	5.445E+05	1.542E+04

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OFFSITE

3

Westinghouse Electric Corporation
Waste Isolation Pilot Plant
TRU waste and Integration Office (WIPP)
P.O. Box 2078
Carlsbad, New Mexico/88221

K. S. Donovan
 B. C. Anderson (2)

ONSITE

8

U.S. Department of Energy-
Richland Operations Office

G. J. Bracken (5)
 DOE-RL Reading Room (3)

A4-02
 A1-65

34

Westinghouse Hanford Company

J. D Anderson	N3-11
R. J. Blanchard	R1-17
H. H. Brown	T5-20
R. J. Cash	H4-23
J. A. Demiter	L5-31
D. R. Duncan	N3-13
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